MULTIDIMENSIONAL WORK SAMPLING TO EVALUATE THE EFFECTS OF COMPUTERIZATION IN AN OUTPATIENT PHARMACY

BY

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In memory of

my father,

Richard D. Lewis

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A study was undertaken to examine the effects of computerization in a large outpatient pharmacy. A multidimensional work sampling technique was used to measure and compare the percent of time spent on various tasks before and after computerization. The percent of time spent on some clerical tasks decreased, as expected, and the percent of time spent on the clinical task of detecting prescription problems increased, but not significantly.

This multidimensional work sampling approach was compared with a direct observation work sampling method to determine how well the two correlate and in what areas they give comparable results. Findings from this section of the study suggest that the multidimensional approach may be more accurate at capturing the clinical aspects of pharmacy practice than a direct observation method.

Additionally, a time clock method was used to measure and compare the time it took to process a prescription, while a survey was used to measure and compare employee satisfaction before and after computerization. The time to process a prescription increased after computerization, primarily due to the increase in time to enter information into the computer.

The job satisfaction of the employees was similar before and after computerization in all categories tested, and no significant changes were found. Lastly, changes made as a result of these findings are discussed.

CHAPTER 1
INTRODUCTION

The amount of time pharmacists spend on nonprofessional versus professional tasks has been a source of concern in the profession. Pharmacists are highly educated, requiring five to six years of higher education, yet many spend much of their time performing tasks that do not require the high level of skills obtained through this education. It has been suggested that technological advances, such as computers, could release pharmacists from routine, clerical tasks, thus allowing more time for professional activities. In order to assess whether computers do in fact allow more time which is used for professional activities, the effects of computer installation on the various activities of the pharmacist must be evaluated.

Purpose

This study was designed to measure the impact of installing a computer in the outpatient pharmacy of a large teaching hospital. A second objective was to evaluate a new work sampling method of collecting data.

In measuring the impact of computer installation, the time spent on clerical and clinical activities was compared before and after computerization based on data collected through a multidimensional work sampling technique. In addition, the time to process a

prescription was compared using a time clock method. Third, in order to assess the impact of computerization on the personnel involved, job satisfaction of the employees was measured and compared before and after computerization. In evaluating the multidimensional work sampling technique, a sample of observations using this method was compared with observations collected by a direct observer.

Background

Advocates of computerization claim that computer usage will alleviate some of the clerical tasks of order processing, which will allow pharmacists more time to pursue clinical activities. However, there is a dearth of literature to substantiate this claim, especially in the outpatient setting. In fact, one study (Kohout, Broekemeir, & Daniels, 1983) recorded a decrease in time spent counseling patients after upgrading a computer system in an outpatient pharmacy.

The majority of previous studies used work sampling techniques that observed the tasks of pharmacists through the use of a camera or an observer. It may be difficult, at best, to measure clinical activities using these techniques because many of the problem-solving or monitoring activities are internal processes not visible to an observer. For example, a pharmacist screening a patient profile for interactions may be recorded as performing an order processing activity.

A relatively new work sampling technique was used in this study to more accurately measure clinical activities, which will in turn allow for a more accurate comparison of these activities before and

after installation of the computer system. More specifically, this study used a multidimensional work sampling approach which is a method of self-reporting work activities (Robertsen, 1982).

This method of recording clinical and clerical functions allowed for the collection of data that would be analyzed for various purposes. One purpose would be to answer the hypotheses tested in this study. Another would be to evaluate how well the computer met the objectives of the pharmacy department in the hospital. The pharmacy department had submitted a proposal for the acquisition of the computer, which listed four primary objectives to be met by the installation of a computer. These were:

1. The improvement of patient care by avoiding drug interactions, increasing patient consultation, avoiding prescription duplication, and providing accurate up-to-date patient profiles.
2. The elimination of hand processing of third-party prescriptions, which would allow more accurate and timely reimbursement.
3. The provision of a more accurate method of fiscal management by improved inventory control for controlled and noncontrolled substances, as well as more efficient prescription pricing and handling.
4. Bringing the pharmacy into compliance with standards of the Joint Commission on Accreditation of Hospitals and the American Society of Hospital Pharmacists, which recommends the use of patient profiles. Prior to installation of the

computer, the outpatient pharmacy had not kept patient profile records on medication use.

An evaluation of whether or not the first three objectives were met can be determined with the data collected by this study.

Justification

Because of the spiraling costs of health care, all health professionals, including pharmacists, are feeling the pressure to contain costs. Many in the health care field are looking to technological changes and job redesign in order to decrease operating costs and/or increase job satisfaction, which would hopefully lead to a decreased turnover of personnel. Yet often these changes are implemented without being evaluated as to their success in reducing costs or improving morale. Without such evaluations, administrators may be reluctant to implement these changes even if they have the potential to achieve the desired outcomes.

Dickson and Rodowskas (1975) and Roberts, Kvalseth, and Jermstad (1982) contend that one way for pharmacy to reduce costs is to utilize personnel resources more efficiently. Effective administration and management in an institutional pharmacy was, in fact, one competency identified as crucial by the American Society of Hospital Pharmacists and the American Association of Colleges of Pharmacy ("Statement on the competencies," 1975).

One way of improving the efficiency of personnel resources that is frequently advocated is to install a computer system in order to reduce clerical activities, so that pharmacists may spend their time

more professionally and productively. The American Pharmaceutical Association (APhA) statement on drug control systems (1974) urges pharmacists to use electronic data processing (EDP) to decrease paper-handling, so that they may expand their clinical roles.

Yet installing a computer system does not guarantee improved efficiency; one must evaluate the changes caused by the installation (Kohout et al., 1983). The changes which must be evaluated include not only the cost savings and shift in activities, but also the feelings of the personnel involved. Measuring these changes is not simple, as each task must be evaluated properly (Davis, 1979) and reliable measures used.

As stated previously, there has not been a great deal of research published which evaluates the impact of computer systems in hospital pharmacies. Burleson (1982), in a comprehensive review of hospital pharmacy computer systems, suggests that the fact that there are so few controlled studies evaluating the effects of a computer system may explain why there is not a greater acceptance of computer systems in hospital pharmacies. Therefore, as all authors reviewed agreed, there is a need for studies evaluating the effects of this new technology in order to document its potential for reducing costs and increasing job satisfaction of pharmacy personnel.

Theoretical Framework

This study evaluated the changes that occurred after installation of a computer system in an outpatient pharmacy setting. This installation of the computer was considered a work innovation. More

specifically, it was classified as a change in work design. Walton (1983) summarizes the conception of work innovation as containing three levels: (a) design techniques, (b) work culture ideals, and (c) intended results. Design techniques are the elements of the work organization that people can alter directly. Intended results are the criteria by which to measure effectiveness. The work culture mediates the impact of the design techniques on the intended results. Presented below is Table 1, adapted from Walton (1983), containing examples of each level.

Table 1
Levels of Work Innovation Conception

Level I Design Techniques	Level II Work culture ideals	Level III Intended results
Job design	High level skills & flexi-ibility in using them	For business:
Pay		Low cost
Supervisor's Role	Openness	Quick Delivery
Training	Mutual influence	Low turnover
Goal setting	Equity	For quality of work life:
Communication	Trust	
Status symbols	Responsiveness	Self-esteem
Leadership patterns	Problem solving	Security

Adapted from Walton (1983).

In this study, the framework was adapted as follows. Level I, design technique, was the element that one can alter directly. Our independent variable, installation of the computer, was the job design change. Level II, work culture ideals, mediates the impact of Level I, installation of the computer, on Level III, intended results. One example Walton (1983) uses as a mediating factor is an increase in high level skills and the flexibility in using them. It was hypothesized that, as a result of the computer, less time would be spent on clerical activities, then allowing more time to be spent on clinical activities which require a higher level of skills.

Level III, intended results, is broken down into two subgroups: (a) intended results for business and (b) intended results for quality of work life. Walton (1983) includes quick delivery as an example of an intended result for business. It was hypothesized that installation of the computer would decrease the time it takes to process a prescription. This, in turn, would result in faster delivery of the prescription to the patient. Intended results for the quality of work life include an increase in self-esteem. It was hypothesized that the use of more complex skills would result in a higher level of job satisfaction. The level ofjob satisfaction was determined by surveying the employees before and after the installation of the computer in order to assess if employees were more satisfied after the computer was operational.

Diagrammatically, the model used in this study is as given in Table 2.

Table 2
Levels of Work Innovation Conception Used in Current Study

Level I Design techniques	Level II Work culture ideals	Level III Intended results
Job design--installation of a computer system	High skill levels--Decrease in clerical activities lead to more time to pursue complex clinical activities.	Business--quick delivery through decreased time to process Rx. Quality of work life--Increase in job satisfaction

CHAPTER 2
REVIEW OF THE LITERATURE

Because the primary goals of this study were to evaluate the effect of computerization on work activities and to compare two methods of work measurement, a review of the use of work measurement in pharmacy literature will be presented first. The measurement of the effect of computerization on job satisfaction was a secondary aspect of this study, so a more limited review of this literature as it pertains specifically to pharmacy will also be presented.

Work Measurement

Methods of work measurement applicable to the practice of pharmacy were outlined by Roberts et al. (1982). These include subjective evaluation, statistical data, self reporting, stop-watch time study, standard time data, and work sampling. This review will examine the use of these techniques in pharmacy research, which will be used to identify dimensions of the jobs of pharmacists used in other research; sampling procedures, sample sizes and sampling frames utilized; methods of validating the work sampling procedures which were used; and the types of data analyses conducted.

Subjective Evaluation

Subjective evaluation is a method whereby one estimates the time spent on various activities based on subjective judgment or past experience. This is not a very precise method and usually deviates, on average, 25% from the true measure (Roberts et al., 1982). Neal (1981) used a form of subjective evaluation when analyzing the costs and savings of a computer information system for a hospital pharmacy department. A labor savings of 3.0 full-time equivalents (FTE) for technicians was estimated by analyzing each job description and using subjective evaluation to predict the impact of computerization on each position.

Kirking, Ascione, Thomas, and Boyd (1984) also utilized this method when researching the relationships between computer use and pharmacists' professional behavior. A survey of both computer users and nonusers asked pharmacists to estimate the time they spent on various professional activities. Mail questionnaires were sent to a sample of southern Michigan pharmacists asking them to record the time spent on the various activities listed, and a response rate of 65.7% yielded 213 usable questionnaires. Those with computers reported encountering more drug-related problems than nonusers, and more frequent contact with physicians concerning drug-therapy problems. There was little difference in the time spent on patient counseling. The authors conclude that while some professional activities may increase with the use of a computer, others may not. The authors admit that this method has limitations, primarily the lack of

precision in estimates, but suggest that it can be a useful method for formulating hypotheses for future research.

Direct Time Study

This method of work measurement involves straightforward timing of specified activities as they are performed. The work must be divided into elements that have a logical sequence, are as short as possible, and have physically observable starting and ending points (Hepler, 1979; Roberts et al., 1982). Direct time study is most appropriately applied to highly repetitive technical tasks such as determining the time it takes to fill a specific type of admixture (Allinson, Stach, Sherrin, & Latiolais, 1979; Turco, 1982) or to compare the time to fill various drug manufacturers' piggyback bottles (Anderson & Soares, 1985).

Although this method is most precise for measuring relatively short times with a detailed breakdown of the elements involved, many researchers in hospital pharmacy use direct time study to estimate longer and more variable activities. For example, studies have used direct time study to collect baseline data on the time to process a prescription (Beaman & Kotzan, 1982; Donehew & Hammerness, 1978), the time spent on controlled substance drug distribution (Blasingame, 1969), and the time spent on clinical activities (Schwartz & Swanson, 1975), but the variance and standard deviations when reported were high.

Direct time methods have also been used in combination with other methods of work measurement. Hanna (1983) combined direct time study

with statistical data measures, such as the number of new and refill inpatient orders and the number of new and routine IV orders, in order to determine the workload. The workload was, in turn, graphed against the time of day in order to provide a visual method for scheduling.

Order processing turnaround time has also been measured using this method. These studies include comparisons of turnaround time of centralized versus decentralized systems (Hibbard, Bosso, Sward, & Baum, 1981; Kvanz, Cummins, Bennett, & Fontana, 1982; Lomonte, Besser, & Thomas, 1983; Reynolds, Johnson, & Longe, 1978), a comparison of nonunit-dose versus unit-dose distribution systems (Norvell, McAllister, & Bailey, 1983), a comparison of filling and checking times when the pharmacy changed from twice daily to once daily cart delivery (Galloway, Leppard, & Spartz, 1978), and comparisons of processing times before and after computerization of an outpatient pharmacy (Moss & Pounders, 1985; Unertl, Weiderholt, & Peterson, 1984). Although each showed a decrease in the time to process orders after the change being studied was implemented, the variation or standard deviation of the total times was again quite large, when it was reported.

The studies by Moss and Pounders (1985) and Unertl et al. (1984) are of particular interest because they deal with the effect of computerization on outpatient prescription processing times. Unertl et al. (1984), when evaluating the implications of installing an outpatient pharmacy computer system, looked at both time and cost considerations. A stop-watch time and motion study was used to evaluate the time considerations. The observer followed 76 sets of

prescriptions (200 total) through the dispensing process before installation and 86 sets of prescriptions (221 total) after installation of the computer. The total dispensing time decreased when the computer was used, but the authors contend that costs associated with the computer were high. This might have been expected because the pharmacy studied fills only 10,000 prescriptions per year, or less than forty per day.

Moss and Pounders (1985) also used a stop-watch method of time study to measure the impact of computerization on dispensing time in an outpatient setting. The steps in processing a prescription were divided into four categories (receipt, delay time, label generation, and filling time) and a varying number of random samples for each step were timed on several different days. Mean times of prescription processing per patient were 7.0 minutes for both new and refill prescriptions before the computer was installed compared with 6.28 minutes for new and 4.61 minutes for refill prescriptions after the computer was installed. Computerization decreased the amount of time spent on miscellaneous activities by 78 minutes per day, but computer-related activities added 58.7 minutes per day. The net time savings, assuming an average prescription volume of 176 per day, would be 196.6 minutes per day. The authors maintain that this time savings will hopefully translate into expanded patient counseling activities and more efficient use of the personnel, yet they did not attempt to measure whether any of these changes had occurred.

Work Sampling

The next type of work measurement to be reviewed is work sampling. It consists of recording a large number of instantaneous observations, taken at random intervals, allowing one to approximate the proportion of a worker's time spent in various activities. This method is most applicable when multiple employees are being studied, when events do not occur in temporal clusters, or when direct time study may interfere with the measured activities (Hepler, 1979). Roberts et al. (1982) summarized some advantages of work sampling as:

1. It allows for simultaneous study of several workers.
2. It yields complete information about the total observation.
3. It is the technique most acceptable to professional workers.

Barnes (1968) also pointed out the following advantages to work sampling:

1. It costs 5-50% less to do than continuous time study.
2. Observations may be spread out over weeks to minimize day to day variations.
3. It decreases somewhat the bias that occurs when the worker knows the continuous study is taking place at that time.

Some drawbacks of work sampling include that one must create task categories which are mutually exclusive and exhaustive, yet keep the number of categories manageable. Also, these categories must be easily recognized by visual observation (Heiland & Richardson, 1957).

Two studies evaluated the work sampling method as applied to pharmacy. Dickson (1978) looked at whether fixed interval work sampling provided results comparable to random interval

observations. He found no significant differences between the two methods, but cautioned that others should replicate these findings before drawing any final conclusions.

The second study, by Segail and Kotzan (1979), compared work sampling data from direct observation with observations sampled from film recorded by a fixed camera. They summarized their findings as follows:

1. Observations by the camera had limited range, whereas the personal observer was not constrained to a limited area.
2. The camera required a more general observation form.
3. Interaction between the direct observer and the staff provided a potential for experimental bias.

Two common objectives of pharmacy research utilizing work sampling are (a) to document baseline workload activities to improve task delegation or staffing patterns and (b) to compare workload activities under different conditions (Kvanz et al., 1982). Studies utilizing work sampling for both of these purposes will be reviewed.

Baseline activities. Examples of hospital pharmacy research which had the purpose of documenting baseline activities in order to improve task delegation or staffing patterns include Barsness and Trinca (1978); Dipiro, Gousse, and Kubica (1979); Dostal, Daniels, Roberts, and Giese (1982); Johnston (1972); Sebastian and Thielke (1983); and Summerfield, Go, Lamy, and Derewicz (1978). Johnston (1972) used pharmacists and pharmacy residents as observers to collect work sampling data for an inpatient pharmacy. Over a 2-week period 12,500 observations of pharmacists and technicians were collected (the

total number of employees observed was not reported). The direct results of this work sampling method were not discussed, but were instead combined with workload data to calculate the number of pharmacists and technicians needed.

Barsness and Trinca (1978) measured the time spent on professional and nonprofessional activities performed by clinical staff pharmacists. Three pharmacists were observed over a 1-week period, and 2,070 observations were recorded. Findings included that the pharmacists studied spent 72% of their time on professional activities and 28% on nonprofessional activities.

Dostal et al. (1982) measured professional and nonprofessional activities for satellite pharmacists under various staffing arrangements. Ten pharmacy administrators and residents recorded 8,440 observations over a 2-week period. Thirty-seven activities were categorized as professional or nonprofessional. Overall, 52% of the pharmacists' time was spent on professional activities, and this percentage increased when one pharmacist worked with more than one technician.

Summerfield et al. (1978) studied both pharmacists and technicians working in a satellite pharmacy using 21 categories of activities. Over a 3-week period, 800 observations per shift were recorded using observational work sampling. Findings included that pharmacists spent 17.5% of their time in unproductive activities compared with 23% for technicians. When the results of the work sampling observations were combined with output and census data, it

was suggested that census alone was not a reliable indicator of pharmacy workload.

Dipiro et al. (1979) utilized work sampling to determine the amount of unproductive or underproductive activities of staff pharmacists, again under various staffing arrangements. Observational work sampling was used, and 7,322 observations were collected. Thirty-three subtasks were collapsed into seven major categories. This study reported the percent of time spent in each category as 19.5% in dispensing requiring professional judgment, 37.8% in dispensing not requiring professional judgment, 6.5% in therapy-related activities, 13.2% idle, 8.9% absent, 9.4% in communication and coordination activities, and 0.5% in outpatient activities.

Sebastian and Thielke (1983) used statistical data including the number of unused and expired large volume parenterals returned to the pharmacy, in combination with work sampling when performing a work analysis of an admixture service. This was the only study reviewed where the authors state that the reliability of the observers of the work sampling portion of the analysis was tested, but they did not report the percent of agreement. Four procedural changes were implemented as a result of the study (automated label preparation, use of a new TPN base solution, batch production, and schedule changes).

Research in the community pharmacy setting have also utilized work sampling to document pharmacists' activities (Boyd, Yung, & Parker, 1982; Dickson & Rodowskas, 1975; Rodowskas & Gagnon, 1972). Rodowskas and Gagnon (1972) studied 29 community pharmacies over a 4-month period. Pharmacists and senior pharmacy student observers used

eight categories when classifying the percent of time spent on various activities. It was reported that the majority of a pharmacist's time (45%) was spent on clerical activities, while 8% was spent on consultative activities.

Dickson and Rodowskas (1975) used observers in 20 chain pharmacies to obtain baseline data on existing community pharmacy practice. They used a work sampling technique to collect 14,400 total observations (720 per pharmacy), and these observations were classified into 28 task categories. Analysis of the results indicated that manager pharmacists spent more time in clerical activities than staff pharmacists, and that idle time was related to prescription volume. They also reported that time spent on patient counseling was related to staffing patterns, prescription volume, and job title, but none of these relationships were significant.

Boyd et al. (1982) also used observational work sampling to collect data in a community pharmacy over a 3-week time period. Forty-four activities were divided among six categories: dispensing, clerical, communications, education, management, and other. Findings included that the pharmacists spent most of their time on nonprofessional activities (82.4% as compared to 17.6% spent on professional activities).

Comparison of activities. Hospital pharmacy research utilizing work sampling for the purpose of comparing activities includes comparisons of centralized versus decentralized activities of pharmacists (John, Burkart, & Lamy, 1976) and nurses (Wadd & Blissenbach, 1984), comprehensive versus product-oriented or

distributive activities (Nelson, Gourley, Tindall, & Anderson, 1977), and activities before and after computer installation (Sikora & Kotzan, 1981) or computer upgrading (Kohout et al., 1983). The first, by John et al. (1976), used an observational work sampling method to compare personnel activities in centralized units with those in decentralized units of the pharmacy. Forty-one subtasks were condensed into four major categories. These were (a) supervisory, (b) therapy-related, (c) dispensing, and (d) educational. Pharmacists and nonpharmacists were evaluated by using 1,083 observations for pharmacists in the decentralized units, 1,130 observations for nonpharmacists in the decentralized units, 1,036 observations for pharmacists in the centralized unit, and 1,219 observations for nonpharmacists in the centralized unit. Major findings included (a) pharmacists in decentralized units spent more time in therapy-related activities than pharmacists in the centralized unit and (b) nonpharmacists in both units spent over 95% of their time in dispensing activities.

Nelson et al. (1977) compared clinical activities of pharmacists providing comprehensive pharmacy services with those offering product-oriented services. Work sampling using observers was conducted over a 6-month period, and 1,451 observations were collected and divided among 19 task categories. These results were compared with those of a previous study of product-oriented pharmacies. Nonproductive time (absent, idle, travel) comprised 15% of the time in the comprehensive service type pharmacy versus 52.1% in the product-oriented service type. The authors found that one-third of the pharmacists' time was

spent in clinical activities in the comprehensive service pharmacy, but they do not compare this to the time spent in clinical activities by the product-oriented pharmacies.

Sikora and Kotzan (1981) used camera-based work sampling to record observations needed before and after computerization of an inpatient hospital pharmacy. A total of 2,000 observations were analyzed, comprised of 900 to 1,000 observations each from before and after the computer installation. Originally 27 task categories were used, but some were collapsed for statistical purposes, resulting in 21 task categories. The major findings included (a) after computerization there was an increase in the time spent working with a profile/CRT and (b) there was a decrease in the time spent typing. They also reported that a tendency was found for personnel to be drawn to the computer terminal area.

Kohout et al. (1983) compared activities in an outpatient setting before and after the upgrading of the computer system. The new system added profiles, drug-drug interactions, auxiliary label notification, and prescription pricing to the existing capabilities. Work sampling was used to collect 5,897 observations (about 750 per worker) and these results were compared with those from a previous study of that pharmacy. These observations were divided into four major categories: (a) prescription processing, (b) inventory maintenance, (c) problem solving, and (d) miscellaneous activities. After the computer was updated, pharmacists were found to spend more time coding prescriptions and less time on patient counseling. Although an

overall time savings occurred, further changes were suggested to increase staff efficiency.

One study of community pharmacies also used work sampling for the purpose of comparing activities and looked specifically at the effect of computerization. McKay, Sharpe, Smith, and Jackson (1979) compared seven treatment pharmacies with five control pharmacies, with a treatment pharmacy being one that installed a computer system during the study. All 12 sites were evaluated before and after the installation of the computers in the treatment pharmacies. The researchers used 105 task categories, but did not report the number of observations conducted. The time spent on distribution of drugs was found to increase in the treatment group after installation of the computers. The authors explained that this increase was due to the extra activities included in the dispensing of a prescription after computerization (screening profiles, performing inventory, pricing, and billing). Before the change, these activities were performed at separate times. No statistically significant increase in professional activities was found after computer installation.

<u>Critique of work sampling research</u>. Work sampling observations should be collected over a long term to decrease the bias from transient causes and increase the likelihood of representative behavior (Hepler, 1979). There seems to be no consensus on the appropriate length of the collection period, as the studies reviewed ranged from a low of 1 week (Barsness & Trinca, 1978) to a high of 6 months (Nelson et al., 1977). On the other hand, the total number of observations collected was more uniform, with most studies collecting

between 750 and 1,000 observations per employee observed. In addition, few studies reported doing any check of measurement reliability or validity. Any type of measurement used in research, including that used in work sampling, should be evaluated in terms of reliability and validity (Anastasi, 1976; Kerlinger, 1973). The importance of the determination of both the reliability and validity of measures of work performance was outlined by Landy and Farr (1983).

In observational studies, the most common reliability measure is observer agreement, or interrater reliability (Barker, 1980). Whenever more than one observer is used, the researcher should compare their recordings for the same events, either during paired observations or while observing simulated work situations such as those on a videotape. The number of agreements divided by the number of agreements and disagreements is a simple formula often used to measure this type of reliability (Barker, 1980; Haynes, 1978). When only one observer is used, the reliability of his or her observations should be established by comparison with a standard established by experts or by an independent trained observer. Some of the studies reviewed utilized more than one observer to collect data (Dostal et al., 1982; John, Burkart, & Lamy, 1976; Johnston, 1972; Nelson et al., 1977; Summerfield et al., 1978), yet none presented data on interobserver agreement.

In addition to interobserver agreement estimates, the reliability of measurement systems, including observational systems, should be evaluated on their internal consistency (Haynes, 1978; Haynes & Wilson, 1979) as interobserver agreement data gives no information on

the consistency of the measure over time or the consistency within homogeneous portions of an instrument (Haynes & Wilson, 1979). None of the pharmacy studies examined reported either internal consistency measures or estimates of the stability of the measures over time.

In addition to establishing the reliability of the instruments, the validity of the instruments, particularly the content validity and, perhaps, the criterion-related validity should be established. Most of the pharmacy research did not report how the content validity of the work dimensions were established. Only the studies which compared two work sampling procedures (Dickson, 1978; Segail & Kotzan, 1979) compared one method of measurement with an independent criterion measure.

The comparison studies reviewed previously used no statistical test, a *t*-test, a *z*-test or a chi-square test to determine if a difference existed in the activities they were comparing. The use of a *z*-test or *t*-test for the comparison of activities in the studies of McKay et al. (1979) and John et al. (1976) may not be an appropriate test because both studies performed multiple tests (20 and 8, respectively), which increases the chance of an erroneous conclusion (Marks, 1982). A chi-square test was used in the studies of John et al. (1979), Kohout et al. (1983), and Sikora and Kotzan (1981). Because the chi-square test does not control for the fact that there are multiple observations of the same subject and thus treats all observations as independent, the large sample sizes involved lead to a chi-square test that is overly sensitive to very slight relationships

among variables. As a possible result, all three studies found highly significant differences ($p<.005$ to $p<.0001$).

Multidimensional Work Sampling

One variation of work sampling that has recently been applied to pharmacy practice is multidimensional work sampling (Hadsall et al., 1982; Robertsen, 1982). Various dimensions of the work are defined which, when examined together, describe the tasks being measured. Examples of dimensions used are the activity, which is the means by which something is accomplished; the contact, which records for whom the activity is performed; and the function, or the purpose of the activity. An example of an observation recorded using this method may be the activity, contact, and function of "phone"-"physician"-"correct problem" to describe calling a physician to discuss a drug interaction.

This procedure involves workers reporting their own activities at randomly sampled intervals in a self-report method. When a random audio signal is sounded, the worker picks one item from each list of dimensions to describe the task being performed. These choices are recorded by the worker at that time by making a series of punches on a portable console. The data are recorded directly onto computer punch cards and can be analyzed quickly and accurately. Robertsen (1982) contends that advantages to this system include (a) there is no observer bias; (b) tasks are easier to divide into mutually exclusive and exhaustive categories; and (c) one is able to measure complex and

unobservable tasks, such as what takes place in confidential meetings, on the phone, or in the pharmacists' head.

Self-reporting may encourage false submission of data, yet Robertsen (1980) contends that this problem is minimized by the multidimensional approach for three reasons. First, the data collected is quantitative, multidimensional, and accumulated at a high rate. It would be very difficult to falsify this type of complex data in a consistent fashion. Secondly, if other workers are being measured simultaneously, the subject would not wish to differ greatly from the others. Lastly, since the subject expends his own time and effort in recording the data, and new programs may be implemented as a result of his effort, he has an incentive to provide accurate data.

Brisley and Oorsett (1980), in an issue of Industrial Engineering devoted to the topic "Work Measurement in the 80's," predicted that computers will become the primary work measurement tool in the 1980s, and one technique to measure labor will be self-taken work sampling. They included multidimensional work sampling as an illustration of this type of technique.

Before the 1973 introduction of multidimensional work sampling in the United States, more than 150 companies in Sweden, Great Britain, Germany, and Switzerland made use of this system ("Are Executives Efficient," 1973). Information on and utilization of this system can be found in a book on time management (Bliss, 1976), dissertations (Hannaway, 197B; Vorwerk, 1979), and various business journals ("Are Executives Efficient," 1973; "Bonanza From Beeps," 1975; Rowen, 197B). Some of the applications of this system include studies of

public officials, scientists, university vice presidents, bank executives, and health-related professionals (Robertsen, 1982).

At this time, hospital pharmacy literature includes only one example of this technique. Hadsall et al. (1982) conducted a work sampling project in order to demonstrate this new multidimensional approach to work sampling. The researchers used six dimensions (which included a total of 53 subcategories) to measure the activities of a clinic pharmacy supervisor. A total of 908 observations were collected over a 6-week period. Findings included that the supervisor spent 27.3% of her time in administrative activities, 20.5% teaching, and 7.6% dispensing. The authors concluded that multidimensional work sampling was an effective and reliable technique which was especially useful for measuring complex tasks, but they did not attempt to validate the instrument, nor did they report how they established the reliability of the procedure.

While the multidimensional work sampling technique is a new method of work sampling, especially in pharmacy research, studies in other fields have utilized other types of automated data collection systems in observational research (Haynes & Wilson, 1979). Direct computer access through punched cards or cassette tapes has made an important contribution to behavioral observation research by facilitating the collection and analysis of behavioral data. Systems, such as the Senders Signals and Receivers System (SSR) developed by Stephenson and Roberts (1977), have been used in observational research in nursing (Gill, White, & Anderson, 1984; White, Wear, & Stephenson, 1983). The SSR is a method of encoding data during the

observation onto an audiocasette tape for high speed transcription by computer. Thus, while the multidimensional work sampling system developed by Robertsen is the only automated data collection used in pharmacy research, other types of systems have been utilized in research reports in other disciplines.

Statistical Data

Statistical data consist of recording the number of work units completed and comparing this to personnel time (Roberts et al., 1982). Examples of completed work units in pharmacy research might include the number of admixture prepared, the number of unit-doses dispensed, or the number of outpatient prescriptions filled. By itself, statistical data may be useful in providing only a rough estimate of the amount of work performed (Roberts et al., 1982).

Many studies in pharmacy have used statistical data in combination with other measures in order to adequately describe the work itself (Hanna, 1983; Hatfield, Alessi, Brown, & Rehder, 1985; Sebastian & Thielke, 1983). Most researchers would not, however, consider a simple count of outputs (e.g., number of prescriptions filled) as being an adequate description of pharmacists' activities or productivity.

Standard Time Data

The standard time for a given operation is the time required on average for a fully trained operator to perform that activity when working at a normal pace (Niebel, 1982). Roberts et al. (1982) distinguishes between standard time data and predetermined motion time

systems (PMTS), but the distinction is not clear. In addition, Niebel (1982) describes predetermined motion time systems as one method of establishing time standards. Therefore, all of the pharmacy research that relies on time standards which were established in previous research will be examined in this section.

One of the first studies in pharmacy research to establish time standards was Rothenbuhler and Archambault (1962). "Measurable" and "nonmeasurable" activities performed in hospital pharmacies were described and quantified in order to determine total staffing needs. Refinements of this method are described by Bartsch, Estreller, and Rothenbuhler (1965) and Hammel, King, and Jones (1977).

The American Hospital Association's Hospital Administrative Services (HAS) attempted to develop a standard method of recording units of work for all departments. Stolar and Tousignaut (1975) modified this method to record pharmacy data through the use of patient product units (PPUs) as a standard time measurement. Another hospital-wide standard time measurement method is the Labor Information System (LIS), which is used to monitor the use of personnel. Hunt, Tuck, and Adams (1982) described the application of this method for the purpose of monitoring pharmacy personnel.

Levin, Letcher, deLeon, and McCart (1980) developed a system of time-weighted standards for distributive and clinical pharmacy services, based on the measurement of patient-care units (PCUs). An adaptation of this method was described and illustrated by Toohey, Herrick, and Troutman (1982).

Strandberg, Smith, and Sanger (1982) attempted to formulate a model to compare hospital pharmacy staffing patterns within groups of similar hospitals. Regression analysis was used to identify nine indicators that were statistically correlated with pharmacy personnel expenditures. The authors conclude that validation of this methodology using larger sample sizes is still needed. Similarly, Roberts et al. (1982) contend that the applicability of standard time data in hospital pharmacy may be limited because of the variability of many factors within each pharmacy.

Summary Table

Many studies utilizing work measurement in pharmacy were reviewed and, although some studies are similar, none are precisely alike. Therefore, a table summarizing these studies is presented (Table 3), which lists the studies chronologically and incorporates the pertinent information from each one.

Job Satisfaction

One prominent theory relating to job satisfaction, developed by Herzberg, is known as the Motivation-Hygiene Theory. Herzberg (1976) identified separate factors that influence work satisfaction (motivators) and work dissatisfaction (hygiene factors). Motivators, also referred to in the pharmacy literature reviewed as intrinsic factors, are concerned with the work itself and are the source of job satisfaction. Hygiene factors, also referred to as extrinsic factors, are associated with the work environment and are the source of job

Table 3
Summary of Pharmacy Research Utilizing Work Measurement

Author	Date	Purpose	Findings and/or Conclusions
Subjective Evaluation			
Neal	Feb 1981	Analyze costs and savings of computer system	Evaluated job descriptions to estimate a labor savings of 3.0 FTE
Kirking et al.	Apr 1984	Effect of computer use on professional behavior	Survey of pharmacists--computer users reported more professional activities
Direct Time Study			
Blasingame	Jan 1969	Measured labor involved with single-unit packaged drugs	Overall time was reduced compared with previous system
Schwartz & Swanson	Dec 1975	Time and cost study of clinical services	Four clinical services provided to 35 patients required about 4.5 hrs/day (4-6)
Donehew & Hammerness	Jan 1978	How to measure time to fill prescriptions	Assembly time and delay time had the greatest impact on filling time
Galloway et al.	Jan 1978	Time saved by changing to once daily delivery	The change from twice daily to once daily cart delivery saved about 1.5 hrs/day
Reynolds et al.	Aug 1978	Centralized vs decentralized delivery times	Delivery time was 138-220 min. centralized vs 1-40 min. decentralized
Allinson et al.	Apr 1979	Compounding time of admixtures in 3 containers	Container design did affect preparation time (Accumed took the least time)
Hibbard et al.	May 1981	Delivery time in decentralized pharmacy	Delivery time was 54±42 min. centralized vs 83±48 min. decentralized
Kvanz et al.	Aug 1982	Centralized vs decentralized activities	Decentralized = more time in education, dispensing, therapy related & stocking
Beaman & Kotzan	Nov 1982	Factors affecting order processing time	Urgency status = only signif. determinant of total filling time (58±49 min.)

Table 3--continued.

Author	Date	Purpose	Findings and/or Conclusions
Direct Time Study--continued			
Turco	Dec 1982	Cost and time study of new admixture system	Time saved by the new system was 13 sec. per bag or about 50 hours per year
Norvell et al.	May 1983	Measured time associated with controlled substances	Nursing, pharmacy and security personnel spent 18,000 hrs annually
Hanna	Jun 1983	Graphic analysis of pharmacy workload	This method is simple and offers a visual method for scheduling
Lomonte et al.	Jun 1983	Turnaround time of decentralized order entry	Avg. turnaround time was 167 min. centralized vs 79 min. decentralized (no sd)
Unertl et al.	Jun 1984	Time and cost study of outpatient computer	Filling time before computer = 221±64 min. vs after computer = 192±57 min.
Moss & Pounders	Feb 1985	Dispensing time of computerized outpatient pharmacy	The net time savings from the computer on an average day would be 196 min.
Anderson & Soares	May 1985	Time and cost of filling piggyback bottles	Of the 4 methods compared, Instafil with vacuum line was more time efficient
Work Sampling			
Rodowskas & Gagnon	Aug 1972	Studied activities of pharmacists in 29 community pharmacies	Pharmacists spent 45% on clerical and 8% on consultative activities
Johnston	Sep 1972	Obtain work sampling data for inpatient pharmacy	Work sampling data was combined with workload data to calculate number of personnel needed
Dickson & Rodowskas	Mar 1975	Observed pharmacists activities in 20 chain pharmacies	Pharmacist managers spent more time in clerical activities than staff RPhs & idle time was related to Rx volume
John et al.	Jan 1976	Compare centralized vs decentralized staff	Decentralized RPh spend more time in therapy-related activities vs centralized

Table 3--continued.

Author	Date	Purpose	Findings and/or Conclusions
<u>Work Sampling--continued</u>			
Nelson et al.	Oct 1977	Compare time spent on clinical activities	Comprehensive pharmacy = more time in clinical activities vs product-oriented
Barsness & Trinca	May 1978	Activities and costs of clinical pharmacists	Clinical pharmacists spent about 72% of their time in professional activities
Summerfield et al.	Dec 1978	Determine staffing requirements	Inpatient census not reliable workload indicator & RPh = 17% nonproductive time
Dipiro et al.	Feb 1979	Evaluate pharmacists' productivity	RPhs spent 25% of time on unproductive & 38% of time on underproductive activities
McKay et al.	Jul-Aug 1979	Compared computerized and noncomputerized community pharmacies	For computerized pharmacies the time spent on distribution activities increased, and no increase was found in professional activities
Sikora & Kotzan	Jun 1981	Analyze change in activities after computer	Less typing time but more processing time & personnel drawn to computer area
Boyd et al.	Fall 1982	Measured pharmacist activities in a community pharmacy	Pharmacists spent 82.4% in nonprofessional activities compared to 17.6% on professional activities
Hadsall et al.	Nov 1982	Illustrate multidimensional work sampling	Useful method of work sampling for the complex tasks of a pharmacist
Dostal et al.	Dec 1982	Compare activities under different staffing	RPh = more professional activities if one RPh had more than one technician
Kohout et al.	Apr 1983	Work sampling after upgrading computer	RPh spent more time on Rx coding and less time on patient counseling
Sebastian & Thielke	Dec 1983	Work analysis of admixture service	This method was useful in evaluating & improving the efficiency of the service

Table 3--continued.

Author	Date	Purpose	Findings and/or Conclusions
Standard Time Data			
Rothenbuhler & Archambault	Apr 1962	Develop method to determine staffing needs	"Measurable" & "nonmeasurable" activities were described and used to determine staffing needs
Bartscht et al.	Oct 1965	Refinement of method to determine staffing needs	Michigan Hospital Methodology Manual technique was described
Stolar & Tousignant	Mar 1975	Proposal of new HAS measurement system	Demonstrated use of patient product units (PPUs) as a standard time measurement
Hammel et al.	Sep 1977	Adaptation and use of work measurement system	Analysis and determination of pharmacy manpower requirements were performed
Levin et al.	Jan 1980	Illustration of work measurement system	Developed patient care units (PCUS) to measure workloads
Hunt et al.	Jan 1982	Illustration of work measurement system	Described the Labor Information System (LIS) to monitor use of pharmacy personnel
Toohey et al.	Jun 1982	Adaptation of workload measurement system	Modified patient care unit (PCU) system provides more precise measurement
Strandberg et al.	Nov 1982	Method for comparing staffing patterns	Mathematical model identified 9 indicators correlated with personnel expenditures

dissatisfaction. Herzberg contends that some of the motivators, including the work itself, have long-term effects towards job satisfaction and should be stressed when restructuring jobs. While the research studies done in pharmacy have not tested the underlying assumptions of Herzberg's theory, many researchers use terms such as intrinsic factors or hygiene factors which are part of Herzberg's theoretical framework.

Job Descriptive Index (JDI)

According to Smith (1974), job satisfaction is important to measure because, under certain circumstances, lack of job satisfaction and particularly job dissatisfaction may lead to behavior such as high turnover and absenteeism. Smith also contends that measurement of job satisfaction may be used as a criteria by which to measure the success of job restructuring. In order to carry out these measurements, Smith (1974) developed and validated an instrument known as the Job Descriptive Index (JDI), which has been used in various work environments including pharmacy settings (Carroll, Shultz, & Gagnon, 1982; Shoaf & Gagnon, 1980). This instrument measures five areas of job satisfaction: the work itself, pay, opportunities for promotion, supervisors, and coworkers. Two of these areas, the work itself and opportunities for promotion, would be considered motivators or intrinsic factors, while the other three would be considered hygiene or extrinsic factors according to the Herzberg classification.

Pharmacy Literature on Job Satisfaction

Studies of pharmacists' job satisfaction have consistently found one aspect of the work itself, the amount of time spent on clinical skills (which utilize higher skill and education) to be related to job satisfaction. One of these studies, by Johnson, Hammel, and Heinen (1977) surveyed hospital pharmacists in Michigan with a 68% response rate. Findings include that staff pharmacists had the lowest level of job satisfaction while clinical pharmacists had the highest level. Similarly, Rauch (1981), when measuring satisfaction of pharmacists who worked in army medical treatment facilities, found that pharmacists providing patient care (a clinical activity) were significantly more satisfied on intrinsic job measures than pharmacists not providing patient care. Yet, they found no significant difference on extrinsic job measures between the same groups.

Another study (Noel, Hammel, & Bootman, 1982) looked at the job satisfaction of both hospital pharmacists and support personnel. Clinical and research pharmacists had the highest scores for job satisfaction, and support personnel reported lower mean scores than all groups of pharmacists. Additionally, a study of Michigan hospital pharmacists (Quandt, McKercher, & Miller, 1982) found that when the job content included clinical services, pharmacists were more satisfied with their jobs, and suggested that any job enrichment program should attempt to provide more clinical activities. Finally, when institutional and community practitioners were compared (Curtiss, Hammel, & Johnson, 1978), practitioners in apothecary-type settings

reported uniformly higher levels of satisfaction than pharmacists in all other settings, and sources of job satisfaction were reported to be work challenge and ability utilization.

Although each of the above studies looked only at a small segment of institutional and community pharmacy personnel, all reached similar conclusions concerning the relationship of clinical skills and job satisfaction. A more recent study (Wilt, 1985) surveyed a sample of all Florida pharmacists, community and hospital alike, to determine their level of job and career satisfaction. Of all job aspects measured, job role (a combination of job variety and job challenge), correlated most highly with both job and career satisfaction. Pharmacists with the opportunity to make use of their skills and ability, and challenged by their work, tended to report a higher degree of job and career satisfaction. Therefore, one suggestion to improve job satisfaction was to alter the job to provide a greater use of skills and abilities, and to provide a challenge in the work.

Summary

A review of various types of work measurement, including their advantages and disadvantages, was presented. Many study designs were previously used by pharmacy researchers, as outlined in the literature review, but all have drawbacks. The most popular method of work sampling is an observer-based study which consists of a researcher trained to observe the pharmacy personnel at predetermined points in time. But interaction between observer and the staff may provide a potential for experimental bias (Segail & Kotzan, 1979), and this

method is costly because of the time spent by the observer (Robertsen, 1982). Cameras have also been used to observe pharmacy personnel, but they have a limited range and can only collect very general observations (Seigal & Kotzan, 1979). Neither of these methods allow for observation of all tasks performed by pharmacists. Pharmacy practice consists of many complex jobs that may not be accessible to an observer since they may take place in a clinical setting, on the telephone, or in a pharmacist's head.

An alternative system is the self-observation system based on diaries, job cards, or questionnaires. But these consume an inordinate amount of time from the employee and may be intentionally or unintentionally biased (Robertsen, 1982). One last drawback to all of the above methods pertains to the problem that while the tasks and activities must be mutually exclusive and exhaustive, they should also be few in number to optimize recording by the observer (Hadsall et al., 1982).

After the types of work measurement were examined, the relevant pharmacy literature utilizing work measurement was reviewed and its major weaknesses were discussed. The major findings of this literature were summarized in table form and used to guide decisions on task categories and sampling framework for this study.

Finally, literature pertaining to the relationship between clinical activities and job satisfaction was reviewed. This literature seems to support the hypothesis that as pharmacists engage in more clinical activities which utilize more complex skills, they are more likely to have a higher level of job satisfaction.

CHAPTER 3
METHODS

This chapter will describe the research objectives, hypotheses, and data collection procedures. The data analysis that was planned is also outlined.

Research Objectives

The objectives of this research were to

1. Evaluate the impact of computerization of an outpatient pharmacy on:
   a. The percent of time spent on clerical functions.
   b. The percent of time spent on clinical functions.
   c. The amount of time it takes to fill a prescription.
   d. The job satisfaction of the employees.
2. Compare the multidimensional work sampling technique with a direct observation technique to determine the level of agreement and the areas in which they give comparable results.

Research Hypotheses

It was hypothesized that:

1. After the computer was installed and operational:
   a. The percent of time spent on clerical activities would decrease.

b. The percent of time spent on clinical activities would increase.

c. The amount of time it takes to fill a prescription would decrease.

d. Job satisfaction of the employees would increase.

2. Multidimensional work sampling would be in substantial agreement with the direct observation technique on clerical or dispensing tasks, but would not agree on clinical activities or decision making categories.

Variables and Their Measurement

The theoretical model outlined previously evaluates the impact of job redesign on intended results for both business and the quality of work life. Job redesign, or the installation of the computer, was the independent variable. This was simply measured by whether the computer was or was not in use at the time of data collection.

The dependent variables include LEVEL II--the mediating variable--and LEVEL III--intended results for business and quality of work life. The mediating variable in this study was the change in the levels of skills used. This was measured by evaluating the change in the percent of time spent on clinical and clerical activities. This was, in turn, measured through the use of a multidimensional work sampling technique outlined in the next section. This technique was also compared with a direct observation work sampling technique.

The second dependent variable evaluated was the intended result for the business, or the change in the amount of time it takes to

process a prescription. These data were collected through a time clock technique. The final dependent variable analyzed was the intended result for the quality of work life, or the change in job satisfaction of the employees. This was measured through a job satisfaction questionnaire. In summary, the variables and their measurements are outlined as follows:

Independent variable	Measurement
Computerization	Whether computer is installed at time of data collection
Dependent variable	**Measurement**
Percent of time spent on clinical activities	Multidimensional work sampling and direct observation
Percent of time spent on clerical activites	Multidimensional work sampling and direct observation
Time to process a prescription	Direct observation
Job satisfaction	Questionnaire

Setting

The setting of this study is the outpatient pharmacy at Shands, a large 475-bed teaching hospital. The outpatient pharmacy is open Monday through Friday from 9 AM to 5:30 PM and is located on the first floor near the outpatient clinic area. Five employees fill approximately 260 prescriptions daily (outpatient clinic, discharge, and employee prescriptions).

The five employees participating in the study included two full-time pharmacists, one full-time pharmacy intern student, and one full-time and one part-time technician. One pharmacist and one technician

from the precomputerization phase of the study were replaced by another pharmacist and technician by the time the postcomputerization phase of the study began.

Measuring Instruments

This section will describe the measurement techniques used. In addition, the procedures used to obtain the data with each instrument will be described.

Multidimensional Work Sampling

The first type of measurement used is multidimensional work sampling, chosen because it allowed the measurement of unobservable tasks, was not overly time consuming for employees, and was used successfully in research in a similar pharmacy setting.

Dimensions. The multidimensional work sampling method measures at least three components or dimensions of job-related behavior. These are activity, function, and contact. "Activity" is the means by which something is performed or accomplished. For example, an activity could be a meeting, phoning, filling, or evaluating. The "function" describes the purpose of the activity. This may include dispensing medication, consultation/advice, or billing. "Contact" describes the person or group for whom the activity is being performed. This could include physician, patient, or nurse. If the employee is not in direct contact with someone when the task is measured, the contact of "self" is recorded. One example of coding would be "meeting 1:1; consultation/advice; patient" for the task of

patient counseling. Hadsall et al. (1982) formulated lists of these dimensions in their study of a clinic pharmacy (see Appendix A). These dimensions were adjusted to accommodate the outpatient pharmacy at Shands Hospital and the purpose of this study. These revised dimensions were reviewed by nine expert judges familiar with the outpatient operation in order to establish the content validity of these dimensions. Dimensions for this study are outlined in Table 4, and their definitions are included in Appendix B.

Clarification of the definitions of some of the functions may be needed. Function 1, "collect/record/give patient information" refers only to "nonprofessional" information that any employee could give or receive and includes information such as the number of refills left, spelling of the patient's name, or how much the prescription will cost. Function 1 does not include the tasks identified by Function 8, "consultation/advice," Function 9 "detect/correct duplication problems," or Function 10 "detect/correct other prescription problems" which are more professional tasks and usually done by the pharmacists or, in some cases, the pharmacy intern student.

The hypotheses of this study were that after computerization there would be an increase in professional functions and a decrease in clerical functions. The professional functions expected to increase were:

Function 8--consultation/advice

Function 9--detect/correct duplication problems

Function 10--detect/correct other prescription problems

Conversely, the clerical functions expected to decrease were:

Function 2--prepare label

Function 3--price prescription

Function 5--bill prescription

Function 11--order stock

The clerical function of collecting and recording patient information (Function 1) was expected to increase somewhat, but this increase would be offset by a decrease in the other clerical functions listed above.

Training. The employees were given a list of the dimensions identified in Table 4, along with a definition of each dimension (Appendix B). They were asked to review the material for a meeting which was held 1 week before data collection. At that meeting, the definitions were explained in detail and examples of their use were given. The employees were then given 2 days to review and ask any questions concerning the dimensions. At the end of the 2-day period, the employees were given a test consisting of 25 examples of tasks which might occur in the outpatient pharmacy (Appendix C), and each employee was asked to independently indicate the three dimensions they would record for these tasks. The answers given were assessed for interrater reliability by correlating each person's response to a "norm" established by expert judges. If interrater reliability, assessed by dividing the number of agreements by the number of agreements and disagreements (Haynes, 1978), was less than .90, retraining for that employee took place until the criterion was met.

Equipment. Consoles approximately the size of a desk top adding machine were provided by the Extensor Corporation. The front of each

Table 4
Dimensions Used in Multidimensional Work Sampling

	Activity		Contact
1.	meeting 1:1	1.	self
2.	meeting 3+	2.	patient/patient representative
3.	phone	3.	other pharmacy personnel
4.	type	4.	supervisor
5.	computer entry	5.	physician
6.	review/check	6.	nurse
7.	sort/file	7.	clerk
8.	write/sign	8.	outside pharmacist
9.	prepare	9.	
10.	transit/waiting	10.	
11.	absent	11.	
12.	other	12.	other

	Function
1.	collect/record/give patient information
2.	prepare label
3.	price prescription
4.	prepare prescription
5.	bill prescription
6.	dispense prescription
7.	collect payment
8.	consultation/advice
9.	detect/correct prescription duplication problems
10.	detect/correct other prescription problems
11.	order/pick up/put up stock
12.	other

console contains a plastic guide under which a computer card is placed. Above this computer card is a plastic window where the code list of dimensions is placed for easy reference. Approximately four times an hour, at random intervals, a "beep" is emitted from the console and a light corresponding to a column on the computer card is activated. The employee is instructed to remove the stylus from its holder (located in upper-right portion of console), and use it to punch three holes in the appropriate column of the computer card corresponding to the task being performed at the time of the "beep." The employee then replaces the stylus in its holder which extinguishes the light above that column.

When a computer card is filled, it is placed in a slot at the back of the machine, and a new card is inserted under the plastic guide. At the end of each week, the completed computer cards were collected by the researcher, and sent to the Extensor Corporation for analysis.

Recording of data. Three days before data were collected, employees were trained to use the consoles provided for recording their tasks. Each employee was given a manual explaining the procedure of the Extensor system, which was reviewed and discussed at that time. On the first day of the study, each employee was given a small console on which to record his tasks. The console was placed near the employee's work station, and a list of the dimensions was placed in a window on each console.

The dimensions listed in Table 4 were recorded on a console as follows:

1. A random "beep" was emitted approximately four times per hour for each person in the pharmacy, at which time a corresponding light was activated on the employee's console.
2. At this time the employee chose one, and only one, item from each dimension which described his or her activity by punching the appropriate three areas on the computer card in the recording machine with the stylus.
3. When an employee left the pharmacy area, he was instructed to check the console upon returning to determine if any lights had been activated while he was gone. If they had, the task accomplished while the employee was absent was to be recorded on the console.
4. Eight tasks (of three dimensions each) could be recorded per computer card with one column for corrections. When a card was filled, the employee was instructed to remove the card, store it in the back of the console, and replace it with another computer card.
5. The cards from the recording machine were collected at the end of each week. Since approximately 900 observations per person would permit reliable estimates (Barnes, 1968), data were collected for six weeks (4 obs/hr X 8 hr X 5 days/wk X 6 weeks = 960 observations).

After a GCC (General Computer Corporation) computer was installed and operational, eight weeks were allowed for the pharmacy personnel to become accustomed to the computer and "work the bugs out." Eight weeks was chosen because it was felt that this was an adequate amount

of time for the employees to become accustomed to the computer, while minimizing the time during which unrelated changes might occur in the pharmacy operation. After the computer was installed and the second phase of data collection was set to begin, the two new employees were trained and the other employees were retrained in order to repeat the 6-week data collection procedure.

Direct Observation

The multidimensional approach was compared with a direct observation approach to work sampling. A sample of approximately 15% of the observations recorded in each 6-week period was also recorded by direct observation to determine the accuracy of the self-reporting technique. Observations were recorded by the principal investigator, who had previously been the outpatient supervisor and developed the definitions of the dimensions for this study. The observer sat in a corner of the pharmacy which afforded a good view of the operation but was out of the traffic pattern of the employees. Interaction was kept at a minimum, but questions concerning the study arose occasionally and were answered at this time.

The observer used the same dimensions listed in Table 4, with the added option of recording a "13" if the function being performed could not be determined. The comparison of the two methods of work sampling using the same dimensions allowed an evaluation of the types of work that can be measured equally well by both methods and the type which yields different results.

Time Clock

Information regarding the amount of time it takes to process a prescription was recorded by a time clock technique. The work flow of the pharmacy before and the flow expected after computerization was outlined (see Appendix D), and it was decided that four points in time would be recorded by three time clocks. The placement of these time clocks is illustrated in a diagram of the outpatient pharmacy (Appendix E). Over a 1-week period, these four points in time were recorded for each set of prescriptions presented for a patient. These points consisted of the times when (a) the set was received into the pharmacy, (b) label generation was completed, (c) the filling process was begun, and (d) the set of prescriptions was completed. These recordings were used to calculate the following four time spans:

Process--The time to process the prescriptions for filling. Before the computer this included logging the prescriptions and typing the label, while after the computer this referred to the time to input the prescription information and print the label.

Delay-- The time from when the prescription was ready to be filled and the time filling began.

Fill-- The time to prepare or fill the prescription orders.

Total-- The total time between the receipt and completion of the prescription.

Job Satisfaction

The job satisfaction questionnaire consisted of the Job Descriptive Index (JDI) (see Appendix F), along with items previously used and validated in research with pharmacists by Wilt in 1985 (Appendix G). The JDI measures five aspects of job satisfaction: the work itself, supervision, other employees, pay, and opportunity for promotion. It has been used in various settings and is thought to demonstrate adequate reliability and validity (Smith, 1974).

The questionnaire used in pharmacy research (Wilt, 1985) utilizes a 5-point Likert-type scale and includes items that measure overall job satisfaction along with items to specifically measure the pharmacist's satisfaction with their job tasks. Reliability and validity of this instrument was assessed and documented by Wilt (1985).

Data Analysis

Multidimensional Work Sampling

The data generated from the multidimensional work sampling portion of the study was directly recorded onto computer cards by the employees through the use of a recording console. These data cards were sent to the Extensor Corporation where this information was processed and sent back in the form of summary and two-dimensional frequency tables.

Data collected before and after computerization was compared using an analysis of variance (ANOVA) procedure. This procedure was

used to determine if there was a significant difference between the two time periods (precomputerization and postcomputerization) on the types of functions performed. This procedure also allowed us to assess if there was a significant difference in functions of the five employees, or if there was a significant change in functions on a week to week basis.

Similar studies (Kohout et al., 1983; Sikora & Kotzan, 1981) used a chi-square test to compare data before and after computerization, but this test is overly sensitive to changes when a large number of observations are included in the analysis. However, a chi-square test was also performed in order to compare these results with the analysis of variance results as a basis of assessing the probable accuracy of previous research findings.

Multidimensional work sampling recordings were compared with a sample of direct observations recordings to determine the level of agreement of the two sets of observations. The following equation was used (Haynes, 1978):

$$\text{Interrater reliability} = \frac{\text{The number of agreements}}{\text{The number of agreements + disagreements}}$$

The interrater reliability was computed for all direct observations, as well as separately for the clinical and clerical functions identified previously. The internal consistency reliability of the multidimensional work sampling data was assessed using the split-half method corrected with the Spearman-Brown prophecy formula. While this method is most commonly used in item analysis of

paper and pencil tests, it is also recommended as a way of determining the internal consistency of observational instruments (Haynes, 1978).

Time Clock

The time it took to process a prescription was measured using a time clock technique. Data on the time to process a prescription were collected on each prescription that was filled in the pharmacy for one week in both the precomputerization and postcomputerization phase of the study. The complete information from the times recorded was used to calculate the mean ($\bar{x}$) and standard deviation (sd) of these observations (n). The amount of time it took to process a prescription before and after computerization was compared using a two-sample *t*-test.

Job Satisfaction

The information collected on the job satisfaction questionnaire was ordinal; therefore, a Wilcoxon matched pairs signed ranks test was used to compare the scores of the employees before and after computerization.

Limitations

Various types of work measurement have been used in pharmacy research, and each has limitations. The major limitation of self-reporting work measurement is that it may be intentionally or unintentionally biased by the employee, whereas direct observation methods may be biased because of the interaction that takes place between the observer and the staff. The major limitations of the

methods used in this study are:

1. Self-reporting data may be biased, although a comparison with direct observations will help determine to what extent this takes place in the multidimensional approach.
2. Interaction between the observer and the staff may be a source of bias when using a direct observation approach.
3. Results are based on the assumption that no other major changes take place during the 8-week time lapse between precomputer and postcomputer recording periods.
4. Because every pharmacy setting will differ somewhat, findings cannot be generalized to other settings.
5. There are a limited number of personnel taking the job satisfaction questionnaire so the Wilcoxon matched pairs signed rank test may not show a difference even if one exists.
6. There was a danger of employee turnover both during data collection periods as well as during the 2-month time lapse between recording periods.

CHAPTER 4
RESULTS

The findings of this study will be presented under four sections. The first section will present the results of the multidimensional work sampling technique which was used to measure and compare the amount of time spent on various tasks both before and after computerization. In the second section, the results of direct observation work sampling are discussed. The direct observation method was used to assess the accuracy of the multidimensional approach and to determine in what areas these two methods gave comparable results. The third section describes the results of a time clock procedure used to compare the time it takes to fill prescriptions before and after computerization. The fourth section presents and compares the job satisfaction levels of the employees before and after computerization.

Multidimensional Work Sampling

A multidimensional work sampling approach was used to measure the amount of time spent on various tasks before and after computerization. The three dimensions recorded using this technique were "activity"--or the means by which something is performed, "contact"--or the person for whom the activity is performed, and "function"--which describes the purpose of the activity.

Precomputerization

The first set of data was collected over a 6-week period in May and June of 1985. A total of 3,096 observations were recorded by the five employees, and these results are presented in Tables 5 through 8. Table 5 is a summary of the percent of time spent on each activity, contact, and function. The most frequent activity was preparation, such as prescription preparation (36.6%), followed by typing (15.4%), writing (12.6%), and meeting with someone on a 1:1 basis (11.2%). The most frequent contact was with oneself (83.6%), followed by the patient or his representative (8.4%), other pharmacy personnel (3.8%), and the physician (1.1%). The most frequent function was preparing the prescription (37.1%), followed by collecting, recording, or giving patient information (17.3%), preparing the label (15.7%), and stocking (3.9%).

Tables 6 through 8 are two dimensional frequency tables of the information presented in Table 5. Table 6 presents what activity was performed with each contact. For example, of the 8.4% of the time spent with the patient, 7.2% was in a 1:1 meeting, while the other 1.2% was spent on the phone with the patient. Table 7 presents what function was performed by the various activities. For example, of the 17.3% of the time spent collecting, recording, and giving patient information, most was done on a 1:1 basis (5.6%), followed by writing down the information (4.4%), and transferring it over the phone (2.8%). Table 8 presents what function was performed by or for each contact. For example, of the 17.3% of the time spent collecting, recording, or giving information, most was done by oneself (9.8%),

Table 5
Group Summary of Oimensions--Precomputerization
(May-June 1985, Group Summary of 5 Participants, Total Observations = 3,096)

Activity		Contact		Function	
Meeting 1:1	11.2%	Self	83.6%	Collect/record/give info	17.3%
Meeting 3+	.1%	Patient/patient rep	8.4%	Prepare label	15.7%
Phone	3.9%	Pharmacy personnel	3.8%	Price prescription	2.2%
Type	15.4%	Supervisor	.2%	Prepare prescription	37.1%
Computer entry		Physician	1.1%	Bill prescription	7.9%
Review/check	2.7%	Nurse	.8%	Dispense prescription	1.0%
Sort/file/retrieve	4.3%	Clerk	.5%	Collect payment	1.1%
Write/sign	12.6%	Outside pharmacist	.1%	Consultation/advice	1.1%
Prepare	36.6%			Oetect/correct duplication	.1%
Transit/waiting	3.7%			Detect/correct other problem	1.0%
Absent	4.6%			Order/pick up/put up stock	3.9%
Other	4.7%	Other	1.5%	Other	11.4%
Adjustments	.1%	Adjustments		Adjustments	.1%
	100.0%		100.0%		100.0%

Table 6
Activity vs Contact Two Dimensional Summary--Precomputerization
(May-June 1985, Group Summary of 5 Participants)

Meeting 1:1	Meeting 3+	Phone	Type	Computer entry	Review/check			Sort/file/retrieve	Write/sign	Prepare	Transit/waiting	Absent	Other	Adj.*
11.2%	.1%	3.9%	15.4%		2.7%		100.0%	4.3%	12.6%	36.6%	3.7%	4.6%	4.7%	.1%
.1		.3	15.4		2.7	Self	83.6%	4.3	12.6	36.5	3.5	3.7	4.5	.1
7.2		1.2				Patient/patient rep.	8.4%				.1			
3.2		.2				Pharmacy personnel	3.8%			.1	.1	.2	.1	
.2						Supervisor	.2%							
		1.0				Physician	1.1%							
.1		.7				Nurse	.8%							
.2		.3				Clerk	.5%							
.1		.1				Outside pharmacist	.1%							
.3		.2				Other	1.4%					.8		
						Adjustments							.1	

Total Observations = 3,096

To find the number of observations of any particular activity, multiply the percentage by the total observations and then divide by 100.
* Adj. = Adjustments

Table 7
Activity vs Function Two Oimensional Summary--Precomputerization
(May-June 1985, Group Summary of 5 Participants)

Meeting 1:1	Meeting 3+	Phone	Type	Computer entry	Review/check			Sort/file/retrieve	Write/sign	Prepare	Transit/waiting	Absent	Other	Adj.*
11.2%	.1%	3.9%	15.4%		2.7%		100.0%	4.3%	12.6%	36.6%	3.7%	4.6%	4.7%	.1%
5.6		2.8	.2		.1	Collect/record/ give info	17.3%	2.1	4.4		.6	.1	1.4	
			15.2			Prepare label	15.7%		.1	.3	.1			
						Price prescription	2.2%		.5	1.7				
					2.6	Prepare prescription	37.1%	.4	1.1	32.6	.3	.1		
.3						8ill prescription	7.9%	.4	4.8	2.8	.1	.2	.1	
.9						Dispense prescription	1.0%	.1		.1				
1.0						Collect payment	1.1%		.1					
1.0		.2				Consultation/advice	1.1%							
						Oetect/correct dupl.	.1%							
.3		.4				Oet./corr. other prob.	1.0%		.3					
		.1				Ord./p.u./put up stock	3.9%	1.0	1.2		.1	1.1	.5	
2.0		.5				Other	11.4%	.3	.3		2.3	3.2	2.8	
						Adjustments	.1%							.1

Total Observations = 3,096

To find the number of observations of any particular activity, multiply the percentage by the total observations and then divide by 100.
* Adj. = Adjustments

Table 8
Contact vs Function Two Dimensional Summary--Precomputerization
(May-June 1985, Group Summary of 5 Participants)

Self	Patient/patient rep	Pharmacy personnel	Supervisor	Physician	Nurse		Total	Clerk	Outside pharmacist	Other	Adj.*
83.6%	8.4%	3.8%	.2%	1.1%	.8%		100.0%	.5%	.1%	1.4%	
9.0	5.6	.8		.7	.5	Collect/record/ give info	17.3%	.4	.1	.1	
15.6						Prepare label	15.7%				
2.2						Price prescription	2.2%				
36.9		.1				Prepare prescription	37.1%				
7.5		.4				Bill prescription	7.9%				
.2	.7					Dispense prescription	1.0%	.1			
.2	1.0					Collect payment	1.1%				
	.8	.1	.1	.1		Consultation/advice	1.1%				
		.1				Detect/correct dupl.	.1%				
.3	.1	.2		.1	.2	Det./corr. other prob.	1.0%				
3.7		.1				Ord./p.u./put up stock	3.9%				
8.0	.1	1.8	.1	.2		Other	11.4%			1.3	
.1					.1	Adjustments	.1%				

Total Observations = 3,096

To find the number of observations of any particular activity, multiply the percentage by the total observations and then divide by 100.
* Adj. = Adjustments

followed by with the patient (5.6%), other pharmacy personnel (.8%), and the physician (.7%).

Postcomputerization

Computer installation and training in its use took place during the first week of July. The second phase of data collection began 2 months later, as the supervisor felt the employees were proficient in their use of the computer by this time. A total of 3,611 observations were recorded during the second phase of data collection (September-October, 1985), and the results are presented in Tables 9 through 12.

Table 9 is a summary of the time spent on each activity, contact, and function during the postcomputerization phase of the study. The most frequent activity during this phase was computer entry (32.8%), followed by preparation (34.3%), meeting on a 1:1 basis (9.9%), and absent (6.2%). The most frequent contact again was with oneself (86.6%), followed by the patient or his representative (7.7%), other pharmacy personnel (3.4%) and the physician (.9%). The most frequent function was now collecting, recording, or giving patient information (45.0%), followed by preparing the prescription (39.2%), and stocking (2.2%).

Tables 10 through 12 are two dimension frequency charts of the information presented in Table 9. For example, Table 10 shows that during this phase of the study, of the 7.7% of the time spent in contact with the patient or his representative, 6.2% was on a 1:1 basis, while the other 1.5% was spent on the phone. Another example from these tables shows that of the 45.0% of time spent collecting,

Table 9
Group Summary of Dimensions--Postcomputerization
(September 1985, Flight 2, Group Summary of 5 Participants, Total Observations = 3,611)

Activity		Contact		Function	
Meeting 1:1	9.9%	Self	86.6%	Collect/record/give info	45.0%
Meeting 3+	.1%	Patient/patient rep	7.7%	Prepare label	.2%
Phone	2.9%	Pharmacy personnel	3.4%	Price prescription	
Type	.3%	Supervisor	.7%	Prepare prescription	39.2%
Computer entry	32.8%	Physician	.9%	Bill prescription	.6%
Review/check	5.6%	Nurse	.1%	Dispense prescription	.4%
Sort/file/retrieve	1.4%	Clerk	.4%	Collect payment	.6%
Write/sign	3.0%	Outside pharmacist	.1%	Consultation/advice	1.1%
Prepare	34.3%			Detect/correct duplication	.1%
Transit/waiting	1.8%			Detect/correct other problem	2.0%
Absent	6.2%			Order/pick up/put up stock	2.2%
Other	1.8%	Other	.3%	Other	8.5%
Adjustments		Adjustments		Adjustments	
	100.0%		100.0%		100.0%

Table 10
Activity vs Contact Two Dimensional Summary--Postcomputerization
(September 1985, Flight 2, Group Summary of 5 Participants)

Meeting 1:1	Meeting 3+	Phone	Type	Computer entry	Review/check			Sort/file/retrieve	Write/sign	Prepare	Transit/waiting	Absent	Other	Adj.*
9.9%	.1%	2.9%	.3%	32.8%	5.6%		100.0%	1.4%	3.0%	34.3%	1.8%	6.2%	1.8%	
			.3	32.7	5.5	Self	86.6%	1.4	3.0	34.3	1.6	6.8	1.7	
6.2		1.5				Patient/patient rep.	7.7%							
2.8	.1	.1				Pharmacy personnel	3.4%				.2	.2		
.7						Supervisor	.7%							
.1		.8				Physician	.9%							
		.1				Nurse	.1%							
.1		.2			.1	Clerk	.4%							
		.1				Outside pharmacist	.1%							
.1		.2				Other	.3%							
						Adjustments								

Total Observations = 3,611

To find the number of observations of any particular activity, multiply the percentage by the total observations and then divide by 100.
* Adj. = Adjustments

recording, or giving patient information, most of this time (32.5%) was spent on the activity of computer entry (see Table 11), while the most frequent contact corresponding with this function was again oneself (36.7%), followed by the patient (5.6%), other pharmacy personnel (1.6%) and the physician (.4%) as shown in Table 12.

Comparison

A comparison of "function" recordings from the two data collection phases is presented in Table 13. The percent of time spent on clerical Functions 2, 3, 5, and 11 decreased as hypothesized. The total decrease of these four functions added to 26.7%, but was offset by an 27.7% increase in time spent on the clerical Function 1, collecting/recording/giving patient information, which was mainly due to the time it took to enter patient data into the computer. The percent of time spent on clinical Functions 8, 9, and 10 was small and only Function 10, detect/correct other problems, increased from 1 to 2% after computer installation, while the other clinical functions showed no change. A chi-square test would indicate a significant difference in overall functions, as well as clerical and clinical functions ($p<.0001$, $p<.0001$, and $p<.005$, respectively), although the small change in clinical activities might not be considered of much practical importance. In fact, the analysis of variance results reported below find this difference to not be significant.

When an analysis of variance is performed on the same data, the results do differ somewhat. Table 14 presents the results from the analysis of variance for clerical functions. As before, the time

Table 11
Activity vs Function Two Dimensional Summary--Postcomputerization
(September 1985, Flight 2, Group Summary of 5 Participants)

Meeting 1:1	Meeting 3+	Phone	Type	Computer entry	Review/check			Sort/file/retrieve	Write/sign	Prepare	Transit/waiting	Absent	Other	Adj.*
9.9%	.1%	2.9%	.3%	32.8%	5.6%		100.0%	1.4%	3.0%	34.3%	1.8%	6.2%	1.8%	
6.1		2.2		32.5	.2	Collect/record/ give info	45.0%	.9	2.6	.1	.3		.2	
			.2			Prepare label	.2%							
						Price prescription								
					5.1	Prepare prescription	39.2%		.1	33.9				
					.2	Bill prescription	.6%		.1	.3				
.4						Dispense prescription	.4%							
.6						Collect payment	.6%							
1.0		.1				Consultation/advice	1.1%							
						Detect/correct dupl.	.1%							
1.3		.5				Det./corr. other prob.	2.0%							
					.1	Ord./p.u./put up stock	2.2%	.5	.1		.2	1.0	.2	
.4	.1			.1		Other	8.5%	.1			1.2	5.2	1.3	
						Adjustments								

Total Observations = 3,611

To find the number of observations of any particular activity, multiply the percentage by the total observations and then divide by 100.
* Adj. = Adjustments

Table 12
Contact vs Function Two Dimensional Summary--Postcomputerization
(September 1985, Flight 2, Group Summary of 5 Participants)

Self	Patient/patient rep	Pharmacy personnel	Supervisor	Physician	Nurse			Clerk	Outside pharmacist	Other	Adj.*
86.6%	7.7%	3.4%	.7%	.9%	.1%		100.0%	.4%	.1%	.3%	
36.7	5.6	1.6	.1	.4	.1	Collect/record/ give info	45.8%	.3	.1	.1	
.2						Prepare label	.2%				
						Price prescription					
39.1						Prepare prescription	39.2%				
.4						Bill prescription	.6%	.1			
	.4					Oispense prescription	.4%				
	.6					Collect payment	.6%				
	.5	.2	.4			Consultation/advice	1.1%				
						Oetect/correct dupl.	.1%				
.1	.5	.7	.2	.4		Oet./corr. other prob.	2.0%			.1	
1.8		.3				Ord./p.u./put up stock	2.2%				
7.9		.5				Other	8.5%			.1	
						Adjustments					

Total Observations = 3,611

To find the number of observations of any particular activity, multiply the percentage by the total observations and then divide by 100.
* Adj. = Adjustments

Table 13
Comparison of Function Results for All Employees

Function		% Before[a] (n=3,096)	% After[b] (n=3,611)	Change
1. Collect/record/give patient information		17.3	45.0	+27.7
2. Prepare label	*	15.7	0.2	-15.5
3. Price prescription	*	2.2	-	-2.2
4. Prepare prescription		37.1	39.2	+2.1
5. Bill prescription	*	7.9	0.6	-7.3
6. Dispense prescription		1.0	0.4	-0.6
7. Collect payment		1.1	0.6	-0.5
8. Consultation/advice	**	1.1	1.1	0
9. Detect/correct duplication problem	**	0.1	0.1	0
10. Detect/correct other problem	**	1.0	2.0	+1.0
11. Order/pick up/put up stock	*	3.9	2.2	-1.7
12. Other		11.5	8.5	-3.0

* Clerical functions expected to decrease.
** Clinical functions expected to increase.
[a] Before = 6 weeks observation in May-June 1985. Average Rx/day = 256.
[b] After = 6 weeks observation in September-October 1985. Average Rx/day = 263.

Table 14
Analysis of Variance for Clerical Functions

Source	df	SS	F	*p* less than
Data Phase (A)	1	9.67	206.58	.0001
Employee (B)	4	4.43	23.64	.0001
Week (C)	5	0.07	0.29	.9149
A X B	4	4.08	21.80	.0001
B X C	20	0.61	0.65	.8280
A X C	5	0.11	0.48	.7860
Error	19	0.89		

spent on clerical functions was significantly different between the first and second phase of data collection (precomputerization and postcomputerization), as shown by a value of $\underline{p}<.0001$. This analysis also suggests that there was a significant difference between employees in the percentage of time spent on clerical functions ($\underline{p}<.0001$), but that there was no significant difference in the percentage of time spent on these functions from week to week ($\underline{p}<.9149$).

A significant interaction between the data phase and the employee was also indicated in Table 14 ($\underline{p}<.0001$). This means that some of the employees differed more in their change of clerical functions between the first and second data phase than others. The most probable reasons for this interaction involves the large change in the time spent by one employee typing prescription labels. Before computerization, one employee was generally assigned to type the prescription labels (Function 2) and spent over 60% of the time performing this task. After the computer was installed, this employee no longer typed any labels, but now spent over 50% of the time collecting and recording information into the computer (Function 1). Other employees also reported a decrease of time spent preparing the label, but none recorded a change of this magnitude.

A comparison of the time spent on Function 1, collecting/recording/giving patient information is presented in Table 15. This function was defined as excluding any professional information exchange and as such is a clerical function, but this function was expected to increase after computerization. As with the other

Table 15
Analysis of Variance for Function 1

Source	df	SS	F	p less than
Data Phase (A)	1	6.37	63.00	.0001
Employee (8)	4	0.82	2.02	.1327
Week (C)	5	0.14	0.29	.9139
A X B	4	2.64	6.52	.0018
B X C	20	0.92	0.46	.9549
A X C	5	0.13	0.26	.9289
Error	19	1.92		

clerical functions, there was a significant difference between the first and second phase of data collection (precomputerization and postcomputerization), with $\underline{p}<.0001$, but this time the clerical function increased significantly in the postcomputerization phase. An interaction between the phase of data collection and the employee was found. This, again, is probably due to the fact that one employee spent a large proportion of time typing during the precomputerization period, and changed to entering information into the computer (Function 1) after computerization. The change in functions for this employee was more drastic than for other employees and seems to be the crucial factor in the employee-data phase interaction.

Table 16 presents the results of the analysis of variance for clinical functions. Unlike the chi-square test results, this type of analysis indicates that there was no significant difference in the time spent on clinical functions between the first and second phase of data collection ($\underline{p}<.8012$). As with the clerical functions, this analysis also found a significant difference between employees in the percentage of time spent on clinical activities ($\underline{p}<.0044$) and found no significant differences from week to week ($\underline{p}<.6672$).

Internal Consistency

The internal consistency of the multidimensional data was tested by comparing functions recorded during the odd weeks (weeks 1, 3, etc.) of data collection with those from even weeks (weeks 2, 4, etc.). The percent of time spent on each function during odd and even weeks was corrected using an arcsine transformation technique, which

Table 16
Analysis of Variance for Clinical Functions

Source	df	SS	F	*p* less than
Data Phase (A)	1	0.01	0.07	.8012
Employee (B)	4	0.77	5.41	.0044
Week (C)	5	0.11	0.65	.6672
A X B	4	0.21	1.46	.2537
B X C	20	0.89	1.25	.3177
A X C	5	0.12	0.67	.6521
Error	19	0.68		

will allow percentage data to be analyzed with parametric tests. These transformed percentages were then analyzed for internal consistency using a split-half method corrected with the Spearman-Brown prophecy formula. The corrected correlation for each function appears in Table 17. The reliability estimates of Functions 7, collect payment, and 8, consultation/advice, are relatively low (.22 and .58, respectively) probably due to the small number of observations in these categories (see Tables 5 and 9). Reliabilities for the other functions are relatively high (.77 to .98), which suggests that the measuring instrument used is internally consistent.

Direct Observation

The multidimensional approach was compared with a sample of direct observations to determine the extent to which the two techniques are in agreement and in what areas they give comparable results. A total of 428 observations were recorded by the observer during the 6-week precomputerization phase of data collection (see Table 18). Of these, 93 (22%) of the function observations did not agree with the multidimensional recordings, which corresponds to an overall interrater reliability of .78. The major contributor to these disagreements was the large number (75) of direct observations classified as "13" or "could not determine." This classification was used if either the employee was not within view, or if the observer could not classify the function based on visual observation alone. An example of the latter would include viewing an employee on the phone but not being able to discern whether the employee was giving "patient

Table 17
Internal Consistency Reliability Estimates for Each Function

Functions	Internal Consistency
1. Collect/record/give patient information	.89
2. Prepare label	.98
3. Price prescription	.84
4. Prepare prescription	.83
5. Bill prescription	.96
6. Dispense prescription	.97
7. Collect payment	.22
8. Consultation/advice	.58
9. Detect/correct duplication problem	.88
10. Detect/correct other problem	.77
11. Order/pick up/put up stock	.92

Table 18
Comparison of Multidimensional Function Recordings with Direct Observation Function Recordings--Precomputerization

First Run--May--June 1985	
Total number of direct observations	428
Number of disagreements because observer could not determine function	75 (18%)
Number of other disagreements	18 (4%)
Total disagreements	93 (22%)
Interrater reliability overall	.78
Interrater reliability of clinical functions	.29
Interrater reliability of clerical functions including Function 11	.81
Interrater reliability of clerical functions excluding Function 11	.85

information" or "consultation/advice." The disagreements which did not involve the "13" code comprised only 4% of the total and no pattern to these disagreements could be determined.

It was hypothesized that the two work sampling techniques would be in substantial agreement on clerical tasks, but not clinical tasks. In addressing these hypotheses, the work samples where both techniques were used were analyzed. Using the multidimensional technique, employees recorded a clinical function (8, 9, or 10) taking place 14 times during the precomputerization period while the observer recorded this as occurring only four of these times, which corresponds to an interrater reliability on clinical functions of .29. In addition, employees recorded a clerical function (2, 3, 5, or 11) taking place 100 times during the precomputerization period, while the observer's recordings agreed with these functions 81 times, for an interrater reliability on clerical functions of .81. The clerical function of picking up stock (11) should perhaps be deleted from this analysis because although it is a clerical function and as such hypothesized to be visually discernable, in fact the employees were out of view when they were picking up stock from the storeroom. If this category is deleted the interrater reliability for clerical functions increases to .85.

A total of 480 direct observations were recorded during the 6-week postcomputerization phase of data collection, of which 63 (13%) function recordings did not agree with the multidimensional recordings (see Table 19). This corresponds to an overall interrater reliability of .87. Again, the major portion of these disagreements (41) were as

Table 19
Comparison of Multidimensional Function Recordings with Direct Observation Function Recordings--Postcomputerization

Second Run--September--October 1985	
Total number of direct observations	480
Number of disagreements because observer could not determine function	41 (8.5%)
Number of other disagreements	22 (4.5%)
Total disagreements	63 (13%)
Interrater reliability overall	.87
Interrater reliability of clinical functions	.47
Interrater reliability of clerical functions including Function 11	.56
Interrater reliability of clerical functions excluding Function 11	.83

a result of the "could not determine" classification used by the observer, although the frequency of this classification was lower than during the first collection period. The other disagreements again comprised about 4% of the total and no pattern was found.

Using the multidimensional technique the employees recorded a clinical function (8, 9, or 10) occurring 30 times during the postcomputerization period, whereas the observer agreed with these recordings 14 times for an interrater reliability on clinical function of .47. Employees recorded a clerical function (2, 3, 5, or 11) as occurring 18 times during this period, while the observer agreed with 10 of these recordings for an interrater reliability on clerical functions of .56. If the function of picking up stock was again deleted from analysis, the interrater reliability of clerical functions increased to .83.

Time Clock

A time clock technique was used to compare the time it took to complete a prescription before and after computerization. These data were analyzed both for sets of prescriptions as well as per prescription. A set of prescriptions was defined as those prescriptions brought in at one time for one patient, and ranged from 1 to 11 independent prescriptions. The data were also analyzed separately for new and refill prescriptions. For ease of analysis, if a person had both new and refill prescriptions, the times were not included in the analysis. This occurred only once in each phase of data collection.

The first phase of data collection extended over a 1-week period in May 1985, and consisted of time recordings of 315 new and 97 refill prescriptions (see Table 20). The average total time to complete a set of new prescriptions was 28.8 minutes or 20.3 minutes for each new prescription. The average total time to complete a set of refill prescriptions was 31.7 minutes, or 23.8 minutes for each refill prescription. Approximately one-half of this total time was comprised of the "delay" time span, or the time between label generation and the beginning of the filling process.

The second set of data was collected over a 1-week period in October 1985, almost four months after computer installation, and consisted of time recordings from 234 new and 97 refill prescriptions (see Table 21). The average total time to complete a set of new prescriptions was 39.5 minutes, or 28.3 minutes for each new prescription. The average total time to complete a set of refill prescriptions was 43.3 minutes, or 30.3 minutes for each refill prescription. For this set of data, well over one-half of this total time was due to the "process" time span, or the time between receipt of the prescription and label generation, which included the time it took to enter patient data into the computer.

Therefore, the time to complete both new and refill prescriptions increased after computer installation. The major reason for this increase was the substantial time it took to enter patient information into the computer. However, it is important to note that before the computer was installed, the outpatient pharmacy did not keep patient profiles, which <u>were</u> provided after computerization. Therefore, if it

Table 20
Comparison of New Prescription Preparation Times

		Before (n=315)	After (n=234)	Change	*p* less than
Per Set of New Prescriptions					
Process	$\bar{x}$	9.7 min.	23.1 min	+13.4 min.	.0001
	sd	(8.4)	(19.2)		
Delay	$\bar{x}$	12.2 min.	7.6 min.	-4.6 min.	.0001
	sd	(10.7)	(8.2)		
Fill	$\bar{x}$	6.9 min.	8.8 min.	+1.9 min.	.007
	sd	(7.3)	(8.4)		
Total	$\bar{x}$	28.8 min.	39.5 min.	+10.7 min.	.0001
	sd	(15.8)	(23.6)		
Per New Prescriptions					
Process1	$\bar{x}$	6.8 min.	16.6 min.	+9.8 min.	.0001
	sd	(6.8)	(16.6)		
Delay1	$\bar{x}$	9.2 min.	5.9 min.	-3.3 min.	.0001
	sd	(9.0)	(7.2)		
Fill1	$\bar{x}$	4.3 min.	5.8 min.	+1.5 min.	.0014
	sd	(4.7)	(5.8)		
Total1	$\bar{x}$	20.3 min.	28.3 min.	+8.0 min.	.0001
	sd	(13.1)	(21.2)		

Table 21
Comparison of Refill Prescription Preparation Times

		Before (n=97)	After (n=97)	Change	$\underline{p}$ less than
<u>Per Set of Refill Prescriptions</u>					
Process	$\bar{x}$	9.7 min.	23.9 min.	+14.2 min.	.0001
	sd	(7.4)	(22.5)		
Delay	$\bar{x}$	14.6 min.	10.0 min.	-4.6 min.	.0249
	sd	(12.4)	(15.8)		
Fill	$\bar{x}$	7.4 min.	9.4 min.	+2.0 min.	.0886
	sd	(7.8)	(8.1)		
Total	$\bar{x}$	31.7 min.	43.3 min.	+11.6min.	.0014
	sd	(19.5)	(29.2)		
<u>Per Refill Prescriptions</u>					
Process1	$\bar{x}$	7.3 min.	16.4 min.	+9.1 min.	.0001
	sd	(6.5)	(17.1)		
Delay1	$\bar{x}$	11.5 min.	6.9 min.	-4.6 min.	.0014
	sd	(11.8)	(7.4)		
Fill1	$\bar{x}$	5.0 min.	7.0 min.	+2.0 min.	.0292
	sd	(5.3)	(6.9)		
Total1	$\bar{x}$	23.8 min.	30.3 min.	+6.5 min.	.0293
	sd	(17.7)	(23.3)		

had been feasible (which it was not), a fairer comparison would have been to ask the employees to keep manual patient profiles during the first phase of the study. With time, as more patients become repeat users, the time it takes to enter patient profile information should decrease. The time to actually fill the prescription increased slightly, but the supervisor felt that this was due to the fact that the employees filling the prescriptions were not as consistently rushed as before computerization, primarily because they would often have to wait for the next set of labels to be generated by the computer.

Job Satisfaction

Job satisfaction of the employees was measured before and after computerization of the pharmacy. Each of the five employees were asked to complete the Job Descriptive Index or JDI (Appendix F), and the pharmacists were also asked to complete the Pharmacists Survey (Appendix G).

The JDI measured five areas of job satisfaction: the work itself, supervision, other employees, pay, and promotion. The results (Table 22) from both phases of data collection indicate that the employees were very satisfied with their supervision and other employees, somewhat satisfied with the work, and dissatisfied with opportunities for promotion. In addition pharmacists were more satisfied with their pay than the technicians.

Again the results were similar for both sets of data. A Wilcoxon matched pairs signed ranks test was used to determine if there was a

Table 22
Job Satisfaction--JDI Scores

Area	Possible Score	Tech 1	Tech 2	Tech 3	RPh 1	RPh 2
Before Computerization						
Work	54	41	37	31	28	29
Supervision	54	42	54	50	46	54
People	54	52	54	49	44	49
Pay	27	3	2	17	15	25
Promotion	27	9	4	10	13	5
Total	216	147	151	157	146	162
After Computerization						
Work	54	36	33	43	24	27
Supervision	54	48	51	46	52	50
People	54	50	54	54	50	51
Pay	27	4	3	15	16	18
Promotion	27	6	5	10	0	4
Total	216	144	146	168	142	150

difference between the total JDI scores, or between the scores for the work itself. No significant difference was found for either set of scores ($p<.4$ and $p<.6$, respectively).

The Pharmacists Survey, which measures job satisfaction using a 1 to 5-point Likert type scale, indicated that the pharmacists were not far from neutral either before or after computerization, with scores of 2.8 and 3.2 during the first phase and 3.1 and 3.2 during the second phase of data collection.

Although a significant difference might not be found even if one exists because of the small number of subjects tested, the results were strikingly similar in all categories tested. It did not appear that there were major changes in the level of job satisfaction of the employees tested.

CHAPTER 5
SUMMARY AND CONCLUSIONS

One of the objectives of this study was to analyze the impact of installing a computer in a large outpatient pharmacy. Advocates of computerization claim that a computer will decrease the time spent on clerical tasks, which will allow pharmacists more time to pursue clinical activities. The literature reviewed presented mixed results with respect to the time saved by computerization. While some studies found an overall time savings for processing prescriptions (Kohout et al., 1983; Moss & Pounders, 1985; Unertl et al., 1984), the findings by Sikora and Kotzan (1981) suggest an overall increase in the time to process a prescription. None of the work sampling literature reviewed found an increase in professional activities, and one study (Kohout et al., 1983) actually found a decrease in the time spent counseling patients.

Because the work sampling techniques used in the cited literature were not ideal for measuring clinical activities, a newer technique, multidimensional work sampling, was used to more accurately record and compare these types of activities. This new technique was also compared with direct observation work sampling in order to assess its accuracy in recording various tasks. A time clock method was used to measure and compare the time it took to process a prescription and a

survey was used to compare the employees' job satisfaction before and after computerization.

Results from the multidimensional work sampling data indicated that the percent of time spent on some clerical activities decreased after computerization, but that this was offset by an increase in the clerical activity of collecting and recording patient information. The percent of time spent on the clinical functions of counseling and detecting duplications did not change. The percent of time spent on the clinical function of detecting other prescription problems increased from 1 to 2%, which is not a significant difference. It should be noted here that even if a decrease in overall clerical functions had occurred, thus providing an opportunity for more clinical functions to be performed, it does not ensure that the pharmacists would use the extra time for clinical functions. Training and encouragement may be needed to promote this type of behavior change.

The multidimensional method of work sampling appeared to be a reliable form of work measurement, as suggested by the relatively high internal consistency reliabilities of most of the functions. The analysis of variance found no significant difference from week to week within the groups of functions analyzed, which further suggests that the method is reliable.

Comparison of the multidimensional technique with the direct observation technique indicated that overall disagreements, excluding those caused by the direct observer recording "could not determine," equaled approximately 4% of the total observations. The large percent

of disagreements caused because the observer could not determine the function (18% precomputerization and 8.5% postcomputerization), suggests that the multidimensional approach may present a more complete measure of the tasks performed. As hypothesized, the two techniques were more highly associated on clerical functions, with interrater reliabilities of .81 and .56, than clinical functions, with interrater reliabilities of .29 and .47. This difference is even more striking when the clerical function of picking up stock, which takes place outside the pharmacy, is deleted from the analysis, since the interrater reliabilities of the clerical functions then increased to .85 and .83, respectively. The difference in interrater reliabilities between clinical and clerical functions is probably due to the fact that clinical functions are difficult to measure using direct observation and that the multidimensional approach may be more useful in capturing these types of activities.

Another finding of this study was that it took more time to fill prescriptions (both new and refill) after the computer was installed and operational. The major reason for this increase was due to the additional time needed to enter information into the computer, as was also suggested by the increase in the percent of time spent on the function of collecting and recording patient information. However, this comparison was not completely fair since the outpatient pharmacy did not keep patient profiles before computerization. Additionally the time spent entering information is expected to decrease with time, as more patients who are repeat users are already included in the computer profiling systems. Nevertheless, a definite bottleneck at

the computer entry step of prescription preparation was identified by the data in the postcomputerization phase.

Reasons for this bottleneck included (a) the GCC computer, which is a powerful system but, as installed, was a relatively slow system for inputing patient information and (b) the employees responsible for entering information into the computer were frequently interrupted by patients waiting to drop off or pick up prescriptions. After the results were presented to the director of pharmacy, plans were made to inquire about upgrading the system in order to speed up input time. Another change that took place as a result of this study was a redefinition of work tasks. In order to alleviate the computer entry bottleneck, the tasks of receiving and dispensing prescriptions were delegated to other employees so that those responsible for entering patient information into the computer would not be interrupted.

The last section of this study compared the job satisfaction of the employees before and after computerization. The results from the two phases of the study were strikingly similar in all categories of job satisfaction tested. Therefore, it did not appear that there were major changes in the level of job satisfaction of the employees tested. Pharmacists' responsibilities before and after computerization stayed basically the same. On an alternating basis the pharmacist at the "A" position was responsible for receiving, reviewing, and logging prescriptions, while the pharmacist at the "B" position was responsible for filling prescriptions with the help of a technician, and for checking and dispensing all finished prescriptions. After computer installation, the pharmacist at the "B"

position seemed to be under less pressure because there was not a continual backlog of prescriptions ready to be filled (but, again there was a backlog at the inputing stage).

In conclusion, although various types of work redesign, including computerization, may be implemented to improve efficiency and/or quality of work life, the actual results of the redesign should be assessed to determine if further changes are needed. Probably no pharmacy manager should assume that freeing employees to perform more professional tasks will actually impel them to do so without training or encouragement. Individual employee data collected by the multidimensional approach indicates that one pharmacist spent twice as much time consulting with the patients as the other pharmacist, both before and after computerization. Another indication that this is probably true is research that found no correlation to exist between the "busyness" of a pharmacy operation and the amount of consultation that took place by pharmacists (Berardo, Kimberlin, & Wilt, 1984; Mason & Svarstad, 1985).

Results from this study suggested that multidimensional work sampling was a reliable method of work sampling and may be more useful in capturing professional activities than a direct observation method for this setting. Application of this method to other pharmacy settings may be useful, and further studies in various settings are highly recommended. Finally, it was also suggested that, in comparing the results before and after the redesign is implemented, an analysis of variance method may be more useful than a chi-square test in determining if a significant change did in fact occur.

APPENDIX A
WORK DIMENSIONS AND CODE LIST
DESIGNED FOR AMBULATORY PHARMACY PRACTICE

Activity	Contact	Function
Telephone	Self	Patient record
Meeting 1:1	Patient/patient advocate	Patient assessment
Meeting 3+	Colleague (R.Ph.)	Dispensing medicine
Read, study	Staff (physician)	Prescribing medicine
Write, dictate, sign	Resident	History (drug)
Prepare	Medical student	History (medical)
Evaluate/review	Pharmacy student/preceptor	Administration
Observe	Nursing staff	Patient billing
Think/plan	Med/surg rep/vendor	Consult/referral
Sort, file, retrieve	Pharmacy support personnel	Teaching
Transit/waiting	Secretary/reception	Research/learning
Other	Other	Other

Adapted from Hadsall et al. (1982).

APPENDIX B
DEFINITIONS OF DIMENSIONS

Activities

1. MEETING 1:1--This includes any interaction with another person and not necessarily just a planned meeting.

2. MEETING 3+--This includes any interaction with three or more people.

3. PHONE--This includes any time you are on the phone when the machine beeps. Even if you are on hold at the time, this activity should be chosen.

4. TYPE--This includes any time spent typing on the typewriter.

5. COMPUTER ENTRY--This includes time spent entering information into the computer through the computer keyboard.

6. REVIEW/CHECK--This will usually deal with checking something that has been prepared previously, like a prescription or a compound.

7. SORT/FILE/RETRIEVE--This includes putting prescriptions in order or filing them or retrieving prescriptions from the file. This may also include batching billing forms. It is used with the stock function to indicate filing stock onto the shelf when you are putting up an order.

8. WRITE/SIGN--This includes activities where you are writing something down, for example, if you are off of the phone transcribing the prescriptions you just received or if you are writing a stores order. If you are on the phone and writing at the same time, use No. 2 instead as your activity.

9. PREPARE--This may include activities such as preparing a prescription or preparing a package for mailing. Examples of these activities are retrieving a drug from the shelf, counting or pricing a prescription, or packaging a mail-out prescription.

10. TRANSIT/WAITING--If the beep catches you traveling from one place to another or waiting for your next activity, this should be recorded. For example, if you are carrying a prescription to be logged in.

11. ABSENT--This includes all times when you are not in the pharmacy when the beep sounds. This includes times when you are running errands, taking a break, or eating lunch.

12. OTHER--This includes activities not covered by the above 11 times.

Contact

1. SELF--This includes times when you are not interacting with anyone.

2. PATIENT/PATIENT REPRESENTATIVE--This includes all customers and the people that are with them.

3. OTHER PHARMACY PERSONNEL--This includes any pharmacy personnel, including in-patient, stores, administrative personnel, and myself.

4. SUPERVISOR--This includes talking to Paul when you are asking him supervisory questions (i.e., you have a problem that is out of the ordinary).

5. PHYSICIAN--This includes all physicians, residents, and dentists whether or not they work at Shands.

6. NURSE--This includes LPNs and RNs.

7. CLERK--This includes emergency room and floor clerks.

8. OUTSIDE PHARMACIST--This includes pharmacists not working for Shands.

12. OTHER--This includes interaction with someone not listed in the above items.

Function

1. COLLECT/RECORD/GIVE PATIENT INFORMATION--This includes giving or taking any information about the patient. One exception is that any professional consultation or advice concerning medications should be recorded under No. 8. Another exception is information used during detection or correction of a prescription problem or duplication should be recorded under No. 9 or No. 10.

2. PREPARE LABEL--This is used primarily when the prescription label is being type. This does not include mail-out labels.

3. PRICE PRESCRIPTION--This includes finding the cost of the drug on the shelf or in the stores book and calculation of the customer's price.

4. PREPARE PRESCRIPTIONS--This ncludes retrieving medications from the shelf, counting the medications, compounding, and putting the medication into containers. This also includes labeling, packaging, and recording mail-out prescriptions and checking any of these activities. This does not include typing or pricing the prescriptions.

5. BILL PRESCRIPTION--This includes filling out the billing forms, ringing the billing forms into the cash register, and getting the forms ready for submission.

6. DISPENSE PRESCRIPTION--This includes handing the prescription to the patient, patient representative, nurse, or clerk.

7. COLLECT PAYMENT--This includes receiving cash, check, or a credit card.

8. CONSULTATION/ADVICE--This includes any professional consultation or advice given to a patient, patient representative, doctor, or nurse considering some aspect of medication. This does not include information as to if the prescription is ready, or the price, etc.

9. DETECT/CORRECT PRESCRIPTION DUPLICATION PROBLEMS--This is reserved for recording the function of catching a problem where the patient already has a prescription for this medication.

10. DETECT/CORRECT OTHER PRESCRIPTION PROBLEMS--This includes no signature, no strength, nonformulary item or a drug interaction.

11. ORDER/PICK UP/PUT UP STOCK--This includes writing an order, calling in an order, picking up an order, or putting stock away. When the computer is installed this will also include reviewing the order printout.

12. OTHER--This includes any function not covered in the above 11 items.

APPENDIX C
TEST GIVEN TO EMPLOYEES

Examples

1. You are phoning in the narcotics order.

2. You are asking Lynne what the best time to take a lunch break would be.

3. A woman is asking you the price of her prescription.

4. You are ringing the billing forms into the register.

5. You are taking a bottle of medicine from the shelf to fill a prescription.

6. You are using the calculator to determine the price of a prescription while preparing the prescription.

7. You are on the phone with a physician because he forgot to put the quantity on the prescription.

8. You are typing a label.

9. You are writing a patient's name in the log book.

10. You are explaining that the prescription you are handing the patient needs to be taken with food or milk.

11. You are writing up a master card form.

12. You are writing up a billing form.

13. You come back from lunch and the red light on your machine is on.

14. You are giving a prescription to an ER clerk.

15. You are on the phone asking the floor nurse to check why you received two prescriptions for the same medication for a patient that is being discharged.

16. You are dropping off the billing forms and when you get back the red light on your machine is on.

17. You are giving a copy of a prescription to another pharmacist from SuperX.

18. You are packaging a mail-out.

19. You are checking a compound to ensure that it was properly prepared.

20. You are sorting billing forms to take to the billing office.

21. You are on your way to the back door to let someone in.

22. You are putting the prescription in numerical order.

23. You are punching the number of tablets you want on the baker cell.

24. You were picking up dietary supplies and when you got back your red light was on.

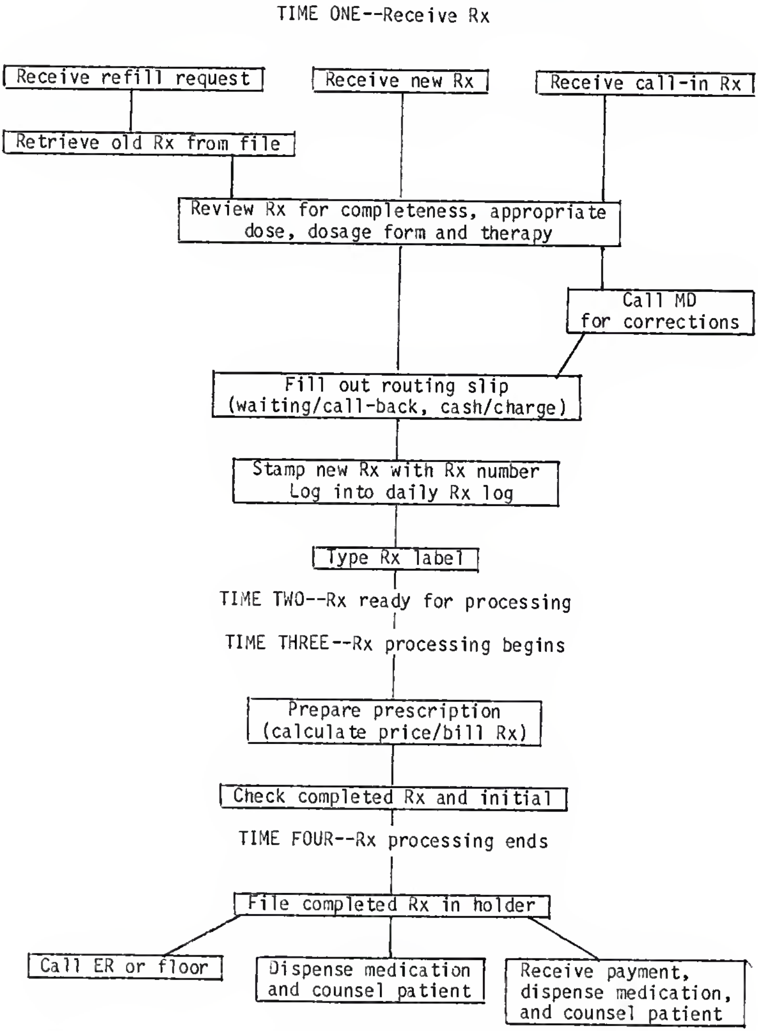
25. You are calling home to check on something.

<u>Answers</u>

1.	3-3-11	14.	1-7-6
2.	1-3-12	15.	3-6-9
3.	1-2-1	16.	11-1-5
4.	12-1-5	17.	3-8-1
5.	9-1-4	18.	9-1-4
6.	9-1-3	19.	6-1-4
7.	3-5-10	20.	7-1-5
8.	4-1-2	21.	10-1-12
9.	8-1-1	22.	7-1-12
10.	1-2-8	23.	9-1-4
11.	8-1-7	24.	11-1-12
12.	8-1-5	25.	3-12-12
13.	11-1-12		

APPENDIX D
OUTPATIENT PHARMACY FLOW CHARTS
BEFORE AND AFTER COMPUTERIZATION

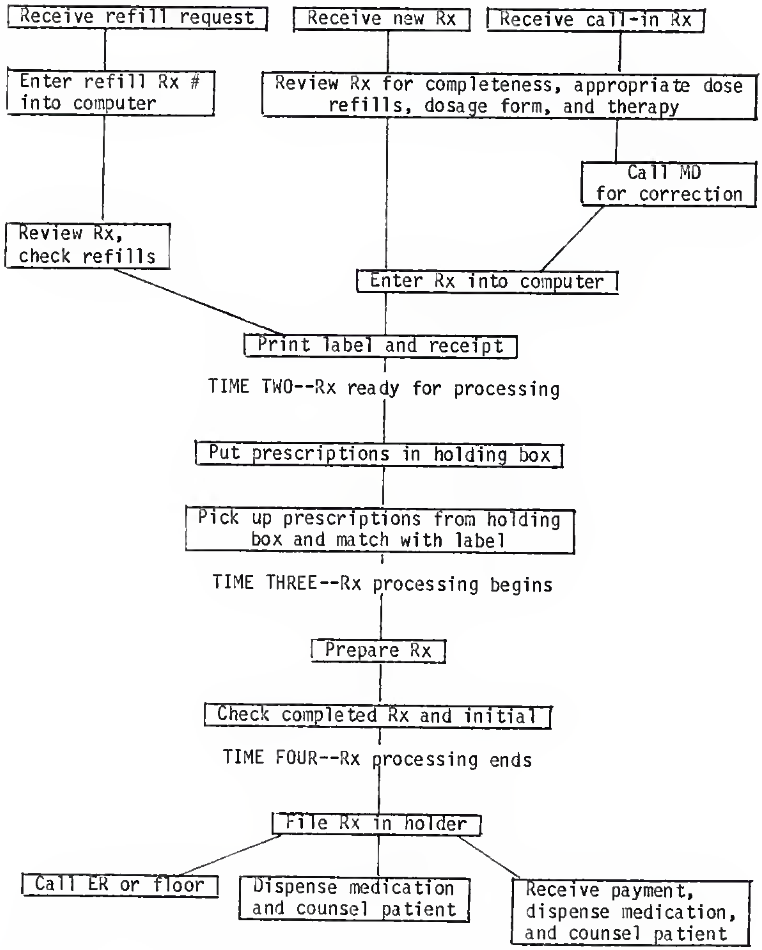
<u>Outpatient Pharmacy Flow Chart--Before Computerization</u>



TIME ONE - TIME TWO = Time to prepare Rx for processing
TIME TWO - TIME THREE = Delay
TIME THREE - TIME FOUR = Filing time
TIME ONE - TIME FOUR = Total

Outpatient Pharmacy Flow Chart--After Computerization

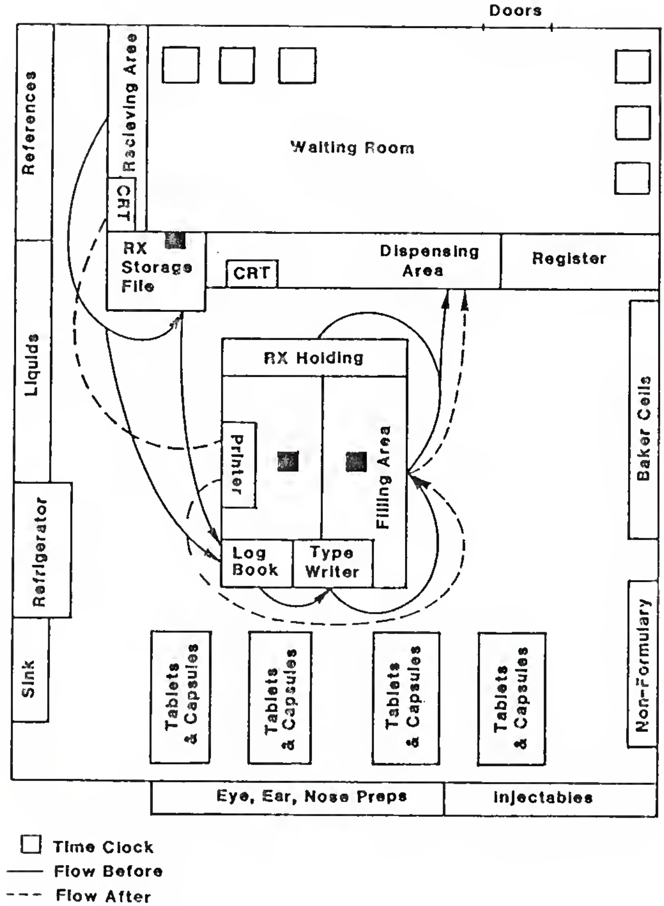
TIME ONE--Receive Rx



TIME ONE - TIME TWO = Time to prepare Rx for processing
TIME TWO - TIME THREE = Delay
TIME THREE - TIME FOUR = Filling time
TIME ONE - TIME FOUR = Total

APPENDIX E
DIAGRAM OF OUTPATIENT PHARMACY

Outpatient Pharmacy Diagram



APPENDIX F
JOB DESCRIPTIVE INDEX

Instructions: Place a "Y" beside an item if this item describes that particular aspect of your job. Place a "N" beside an item that does not describe that particular aspect of your job. Place a "?" if you cannot describe.

WORK

___ Fascinating
___ Routine
___ Satisfying
___ Boring
___ Good
___ Creative
___ Respected
___ Hot
___ Pleasant
___ Useful
___ Tiresome
___ Healthful
___ Challenging
___ On your feet
___ Frustrating
___ Simple
___ Endless
___ Gives sense of accomplishment

SUPERVISION

___ Asks my advice
___ Hard to please
___ Impolite
___ Praises good work
___ Tactful
___ Influential
___ Up-to-date
___ Doesn't supervise enough
___ Quick-tempered
___ Tells me where I stand
___ Annoying
___ Stubborn
___ Knows job well
___ Bad
___ Intelligent
___ Leaves me on my own
___ Around when needed
___ Lazy

PEOPLE

___ Stimulating
___ Boring
___ Slow
___ Ambitious
___ Stupid
___ Responsible
___ Fast
___ Intelligent
___ Easy to make enemies
___ Talk too much
___ Smart
___ Lazy
___ Unpleasant
___ No privacy
___ Active
___ Narrow interests
___ Loyal
___ Hard to meet

PAY

___ Income adequate for normal expenses
___ Satisfactory profit sharing
___ Barely live on income
___ Bad
___ Income provides luxuries
___ Insecure
___ Less than I deserve
___ Highly paid
___ Underpaid

PROMOTIONS

___ Good opportunity for advancement
___ Opportunity somewhat limited
___ Promotion on ability
___ Dead-end job
___ Good chance for promotion
___ Unfair promotion policy
___ Infrequent promotions
___ Regular promotions
___ Fairly good chance for promotion

Adapted from Smith (1974).

APPENOIX G
PHARMACIST JOB SATISFACTION SURVEY

Instructions: Please circle the number of the response which most closely represents your view.

STRONGLY AGREE	TENO TO AGREE	NEITHER AGREE OR DISAGREE	TEND TD DISAGREE	STRONGLY OISAGREE
1	2	3	4	5

Duties (Patient Consultation/Managerial/Oispensing)

1. I am not permitted to perform very many patient consultation duties.
   1 2 3 4 5

2. The type of duties (patient consultation, managerial, dispensing) which management expects me to perform are the same as the type of duties which I expect to perform.
   1 2 3 4 5

3. I am expected to perform too many managerial duties.
   1 2 3 4 5

4. The physical arrangemnt of the prescription area facilitates communication with patients.
   1 2 3 4 5

5. I determine the extent to which I provide patient consultation.
   1 2 3 4 5

6. I am expected to perform too many traditional dispensing duties.
   1 2 3 4 5

7. Management does not make clear what type of duties (patient consultation, managerial, dispensing) are expected to me.
   1 2 3 4 5

8. Nonpharmacists often perform functions which should only be performed by a pharmacist.
   1 2 3 4 5

STRONGLY AGREE	TEND TO AGREE	NEITHER AGREE OR DISAGREE	TEND TO DISAGREE	STRONGLY DISAGREE
1	2	3	4	5

The Clinical Encounter--Patients/Customers

9. In general, I find that patients (customers) attempt to comply with the directions and advice I give them.
   1 2 3 4 5

10. Patients are only concerned about getting their medication as quickly as possible so that they can leave as quickly as possible.
    1 2 3 4 5

11. Patients and customers treat me courteously.
    1 2 3 4 5

12. There is a lot of variety (patient consultation duties, managerial duties, dispensing duties) in my job.
    1 2 3 4 5

13. Patients are only concerned about getting their medication as cheaply as possible.
    1 2 3 4 5

14. Patients show appreciation for the services I provide for them.
    1 2 3 4 5

15. I do not have enough time to perform many patient consultation duties at my job.
    1 2 3 4 5

The Professional Encounter--Coworkers/ Other Health Care Practitioners/Status

16. Physicians consult with me often on professional matters.
    1 2 3 4 5

17. My fellow employees do not treat me with the respect due a professional person.
    1 2 3 4 5

18. Compared to the respect shown to other health care professionals, patients and customers show pharmacists an appropriate amount of respect.
    1 2 3 4 5

STRONGLY AGREE	TEND TO AGREE	NEITHER AGREE OR DISAGREE	TEND TO DISAGREE	STRONGLY DISAGREE
1	2	3	4	5

19. The people with whom I work are friendly.
    1 2 3 4 5

20. Nurses are uncooperative when I initiate communication with them about job-related matters.
    1 2 3 4 5

21. Nurses often initiate consultation with me on professional matters.
    1 2 3 4 5

22. Physicians are uncooperative when I must communicate with them about job-related matters.
    1 2 3 4 5

23. I am satisfied with my on the job relationships I have with my coworkers.
    1 2 3 4 5

24. Considering the amount of education which pharmacists have, society does not accord them the status they deserve.
    1 2 3 4 5

Work/Environment/Rewards

25. My workload is excessive.
    1 2 3 4 5

26. My work schedule is flexible.
    1 2 3 4 5

27. I find challenge in my work.
    1 2 3 4 5

28. The number of hours I work is excessive.
    1 2 3 4 5

29. My environmental working conditions (lighting, air conditioning, heating, bathroom facilities, ventilation, noise level, etc.) are poor.
    1 2 3 4 5

30. The monetary rewards I receive from my work are less than they should be.
    1 2 3 4 5

STRONGLY AGREE	TEND TO AGREE	NEITHER AGREE OR DISAGREE	TEND TO DISAGREE	STRONGLY DISAGREE
1	2	3	4	5

31. I have the opportunity to make use of my skills and abilities at my place of employment.
    1 2 3 4 5

Job Satisfaction In General

32. All things considered, I am satisfied with my current job.
    1 2 3 4 5

33. The idea of spending the remainder of my working life in a job like my current one is depressing.
    1 2 3 4 5

34. I often leave work with a "bad" feeling, a feeling that I am doing something which I do not enjoy.
    1 2 3 4 5

35. I often get so wrapped up (interested) in my work that I lose track of time.
    1 2 3 4 5

Adapted from Wilt (1985).

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BIOGRAPHICAL SKETCH

Karen Lewis Rascati was born in Alexandria, Virginia, on December 23, 1956. She received her B.S. in pharmacy from the University of Florida in 1979. She practiced pharmacy for the Walgreens Company until 1982, at which time she accepted a position as supervisor of Shands Hospital Outpatient Pharmacy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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